United States Court of Appeals

for the

District of Columbia Circuit

TRANSCRIPT OF RECORD

254

IN THE

UNITED STATES COURT OF APPEALS

FOR THE DISTRICT OF COLUMBIA CIRCUIT

24,839

CALVERT CLIFFS' COORDINATING COMMITTEE, INC.,
NATIONAL WILDLIFE FEDERATION, AND
THE SIERRA CLUB,

Petitioners,

v.

U.S. ATOMIC ENERGY COMMISSION,
UNITED STATES OF AMERICA,

Respondents.

BALTIMORE GAS AND ELECTRIC COMPANY,

Intervenors.

BRIEF FOR PETITIONERS

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INDEX

Issue Presented	1
Statement Pursuant to Rule 8(d)	2
References to Rulings	3
Statement of the Case	3
Argument	10
Conclusion..	27

AUTHORITIES CITED

Cases | Page

Cities of Statesville, et al. v. AEC, ___ U.S. App. D.C. ___, ___ F.2d ___ (1969) 19

City of Pittsburgh v. FPC, ___ U.S. App. D.C. ___ 237 F.2d 741 (1956) 19

Dell Publishing Co. v. Summerfield, 198 F.Supp. 843 (D.C., 1961) affirmed 113 U.S. App. D.C. 1, 303 F.2d 766 13

East Texas Motor Freight Lines v. U.S., 96 F.Supp. 424, 427-428 (N.D. Tex., 1951) 13

Eastern Central Motor Carriers Association v. U.S., 239 F.Supp. 591, 594-595 (D.C., 1965) 13

Environmental Defense Fund, Inc., v. Hardin, 428 F.2d 1093 (1970) 13

Environmental Defense Fund, Inc., v. Ruckelshaus, F.2d (C.A. D.C., decided January 7, 1971) 13

Environmental Defense Fund, Inc. v. U.S. Army Corps of Engineers (D. D.C., January 15, 1971) ___ F.Supp. ___ 20

*FPC v. Hunt, 376 U.S. 515,526 (1964) 19

Greater Boston Television Corp. v. FCC (decided November 12, 1970) (C.A. D.C., No. 17,785 slip op. at 15-22) 13

Medical Committee for Human Rights v. SEC, 432 F.2d 659, 668-669 (C.A. D.C., 1970) 13

Moss v. CAB, ___ F.2d ___ (C.A. D.C., 1970) 13

Northern States Power Company v. State of Minnesota, ___ F.Supp. ___ (decided December 22, 1970) 21,22

Power Reactor Development Co. v. IUEW, 367 U.S. 396, 417 (1961) 18

*Public Service Commission of New York v. FPC, ___U.S. D.C. ___, ___F.2d ___, No. 23,446 decided June 29, 1970) (Slip Op. 6)................................... 13

*Sierra Club v. Laird (D. Aug, June 23, 1970) ___F.Supp. ___ (Appeal filed in the U. S. Court of Appeals for the Ninth Circuit)................................... 19

State of New Hampshire v. AEC, 406 F.2d 170 (CA 1st, 1969) cert. den. 395 U.S. 962 (1969)................ 15

Texas Committee on Natural Resources v. U.S. (W.D. Tex., February 5, 1970) ___F.Supp.___..................... 20

Wellford v. Ruckelshaus (decided January 7, 1971) (C.A. D.C., No. 24-434)................................... 13

Wilderness Society v. Hickel (D.D.C., April 23, 1970) 20

Statutes and Regulations

*National Environmental Policy Act, 42 U.S.C......... 3, 11,12, 15, 16, 18, 19

Federal Water Quality Improvement Act of 1970 (33 U.S.C., 1171 P.L. 91-224)....................... 5

Public Law 91-560 (91st Cong., 2nd Sess., amending the Atomic Energy Act of 1954) 19

10 CFR, Part 50, Section 50.109 adopted March 31, 1970 (35 Fed. Reg. 5317)................................. 27

Appendix D to 10 CFR, Part 50........................ 5, 6

Miscellaneous

115 Cong. Rec. (Daily Ed.) S. 17451 (December 20, 1969).. 25

H. Conf. Rep. No. 91-765, 91st Cong., 1st Sess....... 11

*S. Rep. No. 91-296, 91st Cong., 1st Sess............ 10, 11, 25

Hearings before the Joint Committee on Atomic Energy

on Prelicensing Antitrust Review of Nuclear Power Plants (91st Cong., 1st Sess., November 18, 19, and 20, 1969) 26

Report to the Maryland Academy of Sciences by the Study Panel on Nuclear Power Plants (January, 1970) 22, 25

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U.S. ATOMIC ENERGY COMMISSION
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BRIEF FOR PETITIONERS

ISSUE PRESENTED

Whether the Atomic Energy Commission has acted arbitrarily and capriciously by:

1. Refusing to issue an order to show cause why construction of the Calvert Cliffs' Nuclear Power Plant should not be suspended pending a full investigation by the AEC of the environmental impact of the plant;

2. Refusing to consider any modification of the construction permit for the Calvert Cliffs Nuclear Power Plant regardless of the results of the study by the Atomic Energy Commission of the environmental impact of the plant;

3. Refusing to modify the construction permit for the Calvert Cliffs' Nuclear Power Plant to require that technological advances in plant design and equipment be backfitted on the plant where such backfitting will substantially inprove environmental protection.

STATEMENT PURSUANT TO RULE 8(d)

There is now pending before this Court the case of Calvert Cliffs' Coordinating Committee, Inc., et al. v. United States Atomic Energy Commission, et al. (No. 24,871) which involves a challenge to the general rule making procedure adopted by the Atomic Energy Commission implementation of the National Environmental Policy Act. One aspect of that case involves a challenge to the general rules of the Atomic Energy Commission which are challenged here with respect to Calvert Cliffs' Nuclear Power Plant. Pursuant to a request by petitioners, Judge Wright (Acting Chief Judge) entered an order on February 12, 1971, ordering that these two cases be set down for argument on the same day and before the same division of this Court.

Much of the relevant record on review is identical in the two cases. For this reason and in order to reduce costs petitioners have reproduced most of the relevant materials in the Joint Appendix of one, but not both, of the cases. Because reference to the Joint Appendices of each case may occur in both briefs the references in the briefs shall be to Jt. App. (Vol. I) to indicate the Joint Appendix in No. 24,871 and to Jt. App. Vol. II to indicate the Joint Appendix in No. 24,839.

Finally, the written argument in No. 24,839 is virtually identical to one of the written arguments in No. 24,871. Thus virtually the same argument appears in both briefs.

REFERENCES TO RULINGS

In this proceeding petitioners challenge the refusal of the Atomic Energy Commission to take certain action required by the National Environmental Policy Act with respect to the Calvert Cliffs' Nuclear Power Plant. The Atomic Energy Commission set forth its basis for refusing to act in a statement accompanying the adoption of Appendix D to 10 CFR, Part 50 which was published in the Federal Register on December 4, 1970. Jt. App. (Vol. I) 5.

STATEMENT OF THE CASE

On July 7, 1969 the Baltimore Gas and Electric Company (hereinafter BG & E) received from the Atomic Energy Commission (hereinafter AEC), construction permits for Units 1 and 2 of the Calvert Cliffs' Nuclear Power Plant on Chesapeake Bay in Maryland. Jt. App. (Vol. II) 11. At that time the AEC did not have authority to consider non-radiological environmental factors in granting the construction permits. On Decmeber 22, 1969, Congress passed the National Environmental Policy Act (hereinafter NEPA) 1/ which, *inter alia*, expanded the jurisdiction of the AEC and other federal agencies by

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1/ The President signed the bill on January 1, 1970 and it became effective immediately. 42 U.S.C. 4321 et seq. (P.L. 91-190). The full text of the statute is set out in the Addendum attached to the brief in No. 24,871.

requiring that environmental protection be provided in all agency actions and that with respect to major agency actions which would significantly affect the enviornment the agency must prepare a detailed environmental statement which contained an indepth study and analysis of the impact of the proposed action on the environment and steps which should be taken to avoid any adverse impact including abandonment of the proposal. Sections 101 and 102 of NEPA.

Pursuant to this authority the AEC on April 2, 1970 (35 Fed. Reg. 5463) adopted Appendix D to 10 CFR, Part 50 [2/] which *inter alia* provided that both the issuance of construction permits and operating licenses for nuclear power plants involved major action which would significantly affect the environment. Thus under NEPA issuance of construction permits or operating licenses should occur only when there is due regard for environmental protection and only when a detailed environmental statement has been prepared. In the case of the operating license the AEC has determined that this statement would include only a discussion of those aspects of the environmental impact of the plant that differed substantially from

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2/ Appendix D is modified substantially in the version published on December 4, 1970. Jt. App. (Vol. I) 5. Another draft of Appendix D appeared on June 3, 1970, Jt. App. (Vol. II) 169.

the discussion in the detailed statement prepared at the construction permit stage. The AEC also now requires all applicants for construction permits and operating licenses to submit with their application an environmental report which would discuss the same issues to be examined in the detailed environmental statement.

On June 3, 1970, the AEC published for comment in the Federal Register a new proposed Appendix D to 10 CFR, Part 50 (hereinafter AppendixD).[3/] Jt. App. (Vol. II) 169. In both, this verions of Appendix D and the April 2 version the AEC made no proposal for early consideration of the environmental impact of plants such as Calvert Cliffs (where construction permits had been issued without regard for the non-radiological environmental impact of the plant) nor was any provision made to modify the construction permits granted to such plants to provide for environmental protection. The proposed Appendix D postponed these environmental considerations until the issuance of the operating license thus permitting the continued construction of the plant to foreclose certain alternatives in design which might be inexpensively incorporated during construction but would ultimately be regarded as requiring excessively expensive replacement and redesign at the operating license stage. Appendix D also failed to

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3/ The earlier version of Appendix D published on April 2, 1970 preceded the April 3, 1970 enactment of the Federal Water Quality Improvement Act of 1970 (33 U.S.C., 1171 P.L. 91-224). The AEC determined that Appendix D needed to be modified to reflect the requirements of the new statute.

amend Section 50.109(a) of 10 CFR, Part 50 (which requires the addition, elimination or modification of structures, systems or components of nuclear power plants if such changes will substantially add to protection of the public health and safety) to provide a similar requirement where substantial additional protection of the environment would occur.

Petitioners in this proceeding filed with the AEC on June 29, 1970, a request that the AEC apply the following procedures to the Calvert Cliffs plant and adopt these procedures as general AEC regulations (Jt. App. (Vol. II) 31):

> 1) The AEC should immediately order all owners of nuclear power plants which had received construction permits without consideration of adverse environmental effects, such as Calvert Cliffs, to submit an applicants environmental report.
>
> 2) The AEC should immediately (a) prepare the detailed statement with respect to each such nuclear power plant and (b) modify, suspend or revoke the construction permit of each plant as required by the environmental facts uncovered.
>
> 3) The AEC should issue to all owners of these nuclear power plants an order to show cause why construction of the plant should not be suspended pending completion of the preceding two procedures.
>
> 4) The AEC should immediately impose as a condition of all construction permits an obligation on the owner to backfit technological advances which will substantially improve environmental protection.

On July 27, 1970, the AEC determined that the request for general relief should be treated as comments on the proposed Appendix D and that the request for specific relief with respect to the

Calvert Cliffs plant should be postponed until the general rule-making was completed. Jt. App. (Vol. II) 173.

On November 12, 1970, no further action having been taken either on the general rule making or on the specific requests related to the Calvert Cliffs' plant, petitioners filed a Supplemental Memorandum in support of their earlier petition. Jt. App. (Vol. II), 75. This memorandum included reference to a decision by the Maryland Court of Appeals on October 23, 1970, that determined that the Calvert Cliffs' plant was being constructed without a required certificate of convenience and necessity from the Maryland Public Service Commission. Jt. App. (Vol. II), 85. On November 4, 1970, the Public Service Commission issued an order that on November 6, 1970, all construction on the Calvert Cliffs' plant should cease until the Public Service Commission had held a public hearing and determined if a construction permit should be issued and if so upon what conditions including conditions to protect the environment. Jt. App. (Vol. II), 80. A stay of that order was obtained by BG & E on November 9, 1970.

In their Supplemental Memorandum petitioners stressed the fact that several months had passed since the original petition was filed with the AEC and that during that time substantial additional construction had occurred at the Calvert Cliffs' plant. In addition petitioners noted that the pending review of the Calvert Cliffs plant by the Maryland Public Service Commission and the possible imposition of design changes on the plant by the Public Service Commission made this a particularly propitious time for the AEC to take the action requested by petitioners. The Supplemental Memorandum requested that

action be taken on or before November 22, 1970. No action having been taken by that date petitioners filed this appeal on November 25, 1970.

On December 4, 1970, the AEC published in the Federal Register its long awaited revised Appendix D. Accompanying that document was a statement of the AEC's reasons for its actions including reference to the petitioners requests. The revised Appendix D adopted petitioner's request that in cases such as Calvert Cliffs the applicant be required to immediately submit an environmental report and not await the submission of its application for an operating license. Appendix D also requires the AEC to immediately prepare the detailed environmental statement for these plants. However, the AEC refused to consider modification of the construction permits of any plants based upon the data a obtained in preparing the environmental statement. It also refused to require that these construction permits be modified to require that technological advances be backfitted if there will be a substantial improvement in environmental protection. With respect to the issuance of show cause orders the AEC refused to provide for issuance of such orders in all cases such as Calvert Cliffs, where a construction permit had been issued without consideration of the environmental impact of the plant. Jt. App. (Vol. I), 7.

On January 5, 1971, the AEC advised BG & E by letter of its December 4, 1970 Appendix D insofar as that regulation applied to the Calvert Cliffs' plant. With respect to the only issue relevant here--the submission of the applicants environmental report -- the

AEC noted that BG & E had submitted such a report on November 8, 1970 (a copy of which was forwarded to petitioners on November 25, 1970 (Jt. App. (Vol. II), 178)), and that the AEC was in the process of preparing a draft environmental statement to be circulated to federal and state agencies for comment. Jt. App. (Vol. II), 203.

On January 19, 1971, the Maryland Public Service Commission issued a certificate of convenience and necessity to BG & E for its Calvert Cliffs' plant and imposed as one of the conditions of that certificate a requirement that BG & E backfit technological advances that provide reasonable additional protection, necessary for the public health and safety or protection of the environment.

ARGUMENT

Introduction

Congress enacted the National Environmental Policy Act in response to the growing national environmental crisis. The major cause of this crisis has been the (S. Rep. No. 91-296, supra, p. 5 (Add. 15A):*

> Failure to formualte a comprehensive national [environmental] policy. Policy is established by default and inaction. Environmental problems are only dealt with when they reach crisis proportions. Public desires and aspirations are seldom consulted. Important decisions concerning the use and the shape of man's future, environment continue to be made in small but steady increments which perpetuate rather than avoid the recognized mistakes of previous decades. (Brackets added)

In NEPA Congress responded to the growing environmental crisis and its causes in three ways. First, NEPA sets forth in Section 101 (Add. 6A) a broad and comprehensive statement of environmental objectives which in effect, amends the authorizing legislation for all federal agencies and departments to include these environmental objectives in their legislative mandates. S. Rep. No. 91-269, supra, p. 9 (Add. 18A).

Second, NEPA establishes in the Executive Office of the President, a Council on Environmental Quality to analyze and interpret environmental trends, to appraise Federal Government programs in light of the environmental policy established by NEPA, to be responsive to the scientific, economic, social, esthetic and cultural needs of the Nation and to formulate and recommend national policies

* "Add" cites are to the pages of the Addendum bound with the brief in No. 24,871.

to promote the improvement of the quality of the enviornment. Section 202 of NEPA (Add. 8A).

Finally, NEPA requires all Federal departments and agencies to interpret and administer their policies, regulations and public laws, to the fullest extent possible, in accordance with the environmental objectives of Section 101 of NEPA. Section 102(1) of NEPA. (Add. 7A). This latter directive was accompanied by eight specific procedures which all federal agencies and departments must follow in order to insure compliance with the environmental policies set forth in Section 101 of NEPA. Section 102(2) of NEPA. (Add. 7A). The purpose of Section 102 was explained in the Senate Committee Report 4/ (S. Rep. No. 91-296, supra, pp. 19-20 (Add. 30A-31A)):

> The policies and goals set forth in section 101 can be implemented if they are incorporated into the ongoing activities of the Federal Government in carrying out its other responsibilities to the public. In many areas of Federal action there is no body of experience or precedent for substantial and consistent consideration of environmental factors in decisionmaking. In some areas of Federal activity, existing legislation does not provide clear authority for the consideration of environmental factors which conflict with other objectives.

* * * *

4/ Section 102 was not included in the original House bill and was based on the provision as originally included in the Senate bill. H. Conf. Rep. No. 91-765, 91st Cong., 1st Sess. Add. 60A-61A.

> To remedy present shortcomings in the legislative foundation of existing programs, and to establish action-forcing procedures which will help to insure that the policies enunciated in section 101 are implemented, section 102 authorizes and directs that the existing body of Federal law, regulation, and policy be interpreted and administered to the fullest extent possible in accordance with the policies set forth in this act. It further establishes a number of operating procedures to be followed by all Federal agencies.

The operating procedures required by Sections 102(1) and 102(2)(A)(B)(D) and (G) require that agency decisions be made only after full consideration has been given to environmental amenities and values, alternative courses of action, ecological information in planning and development and the general principles in Section 101. In the case of federal actions significantly affecting the environment, Section 102(2)(c) requires the federal agency to prepare a detailed statement on the environmental considerations relevant to the proposed action. This detailed statement must accompany the agency proposal for action through the agency review process. Thus, in certain cases, the agency in the course of making its decision on proposed actions must not only condition its action upon full consideration of environmental values but must also meet the additional burden of preparing a detailed analysis of environmental factors relevant to the proposed action prior to the final decision being made.

This Court has recently emphasized on a number of occasions the requirement that when an agency acts or refuses to act in response to a petition filed with the agency, it must (<u>Public Service Commission</u>

of New York v. FPC, ___ U.S. App. D.C. ___, ___ F. 2d ___, No. 23,446 decided June 29, 1970) (Slip Op. 6):

> set forth convincing reasons for its determination in sufficient detail to allow the validity of those reasons to be critically examined by the parties adversely affected and to allow this Court to pass on the reasonableness of the Commission's conclusions.

Accord, Environmental Defense Fund, Inc. v. Ruckelshaus, ___ F. 2d ___ (C.A. D.C., decided January 7, 1971; Environmental Defense Fund, Inc. v. Hardin, 428 F. 2d 1093 (1970); Greater Boston Television Corp. v. FCC (decided November 12, 1970) (C.A. D.C., No. 17,785 slip op. at 15-22); Medical Committee for Human Rights v. SEC, 432 F. 2d 659, 668-669 (C.A. D.C., 1970); Moss v. CAB, 430 F. 2d 891 (C.A. D.C., 1970); Wellford v. Ruckelshaus (decided January 7, 1971) (C.A. D.C., No. 24,434).

In the instant case the AEC has refused to take action with respect to the Calvert Cliffs' nuclear power plant and has given no adequate reason for its failure to act. The explanation of the AEC's failure to act, to the extent it is given, is unreasonable and inconsistent with the requirements of the National Environmental Policy Act. The AEC has acted arbitrarily and capriciously and its action is without rational basis. Eastern Central Motor Carriers Association v. U.S. 239 F. Supp. 591, 594-595 (D.C., 1965); Dell Publishing Co. v. Summerfield, 198 F. Supp. 843 (D.C., 1961) affirmed 113 U.S. App. D.C. 1, 303 F. 2d 766; East Texas Motor Freight Lines v. U.S., 96 F. Supp. 424, 427-428 (N.D. Tex., 1951).

We therefore urge this Court to reverse the AEC's refusal to act and to require the AEC to take the action requested by petitioners with respect to the Calvert Cliffs' nuclear power plant.

THE ATOMIC ENERGY COMMISSION WAS ARBITRARY AND CAPRICIOUS IN REFUSING TO APPLY THE REQUIREMENTS OF THE NATIONAL ENVIRONMENTAL POLICY ACT TO THE CALVERT CLIFFS' NUCLEAR POWER PLANT

The issue involved here is how federal agencies which oversee continuing projects which can have a significant affect on the enviornment are to apply NEPA to these projects. The AEC in its application of NEPA to the continuing project of construction of a nuclear power plant differs from many other Federal Agencies because of two factors. First, the AEC did not have the authority to consider non-radiological environmental factors prior to the enactment of NEPA (see State of New Hampshire v. AEC, 406 F. 2d 170 (CA 1st, 1969) cert. den. 395 U.S. 962 (1969)) and thus construction of these plants is proceeding without the AEC having giving any consideration to the environmental impact of the plant. Second, the AEC ultimately will have to fully explore the environmental impact of the plant prior to granting an operating license because the act of granting an operating license is a major federal action significantly affecting the environment within the meaning of Section 102(2)(C) of NEPA. Appendix D, Paragraph 2 (Jt. App. (Vol. I), 9).

In Appendix D the AEC has recognized the need to expedite examination of the environmental impact of plants such as Calvert Cliffs for which no previous exploration of the environmental impact of the plant has occurred. It has required immediate submission of

environmental reports by the applicant and immediate preparation of the detailed environmental statement by the AEC. Appendix D, Paragraph 1 (Jt. App. (Vol. I), 9). The narrow issue here is whether the AEC, having recognized the need to act, has, "to the fullest extent possible" interpreted and administered its policies and regulations in accordance with the policies of NEPA. Section 102 of NEPA.

In its Interim Guidelines on Section 102(2)(C) of NEPA (35 Fed. Reg. 7390 (Paragraph 11) (May 12, 1970)[5/] the Council on Environmental Quality referred to continuing federal projects and established the following rule with respect to the preparation of detailed environmental statements under Section 102(2)(C):

> Application of section 102(2)(C) procedure to existing projects and programs. To the fullest extent possible the section 102 (2)(C) procedure should be applied to further major Federal actions having a significant effect on the environment even though they arise from projects or programs initiated prior to enactment of Public Law 91-190 on January 1, 1970. Where it is not practicable to reassess the basic course of action, it is still important that further incremental major actions be shaped so as to minimize adverse environmental consequences. It is also important in further action that account be taken of environmental consequences not fully evaluated at the outset of the project or program.

5/ The Guidelines were adopted in final form on January 22, 1971, (36 Fed. Reg. 1398, January 28, 1971) and Paragraph 11 was adopted without change.

The AEC has not complied with this requirement. The AEC procedures have not been "shaped so as to minimize adverse environmental consequences". In refusing to utilize the information obtained in the preparation of the detailed environmental statement as a basis for modifying, suspending or revoking the construction permit the AEC makes the entire procedure as related to on going and previously unexamined projects totally meaningless. The purpose of the preparation of the detailed statement is not merely to set forth a catalogue of disastrous environmental problems about which nothing is to be done. The purpose is obviously to use that data as a basis for corrective action. Once the AEC has evidence which establishes that a particular plant will cause an avoidable adverse environmental impact, it is bound by NEPA to require that steps be taken by the applicant to avoid the problem or to find that other overriding policy considerations prevent steps being taken to avoid the environmental problem.

Closely related to the failure of the AEC to take action based upon its examination of the environmental impact of a proposed plant is the failure of the AEC to immediately issue to these plants an order to show cause why construction of the plant should not be suspended during preparation of the detailed environmental statement. It is only through the adoption of both procedures that

the AEC can prevent the very fact of continued construction of the plant from foreclosing possible environmental protection modifications at the operating license stage.[6/]

One of the critical examinations required under NEPA is an examination of alternatives to the proposed action. Sections 102 (2)(C)(iii) and 102(2)(D). The feasibility of proposed alternatives will depend in part upon a balancing between the cost of the alternative and the benefit to be obtained from it.[7/] Thus, as plant construction proceeds the alternatives to the plant location, design and operation become drastically reduced. If the imposition of conditions to protect the environment is deferred until the operating license

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6/ The issuance of an order to show cause would permit the applicant to make its case for the continued construction of the plant if some overriding need were established. The public would be allowed to demonstrate in what manner further construction would foreclose possibly important environmental modifications in the plant. Thus the procedure does not compel a shutdown of construction but merely compels the AEC to resolve the question of whether to issue an order for suspension of construction in the light of a presentation to it by applicant and the public of the relevant considerations.

7/ In this regard NEPA apparently differs from the mandate contained in the Atomic Energy Act of 1954 to protect public health and safety for the latter has been interpreted as requiring the AEC to totally disregard the investment in the plant when considering whether to issue an operating license and to be concerned solely with the question of safety of the public. Power Reactor Development Co. v. IUEW, 367 U.S. 396 (1961). Even in that case Justice Douglas, in dissent observed (367 U.S. at 417):

> . . . when that point is reached [the operating license hearing], when millions have been invested, the momentum is on the side of the applicant, not on the side of the public. The momentum is not only generated by the desire to salvage investments. No agency wants to be the architect of a "white elephant".

That observation is particularly relevant here.

hearing there will be, in the words of NEPA (Section 102(2)(C)(v)) "irreversible and irretrievable commitment[s] of resources. . ." which can only serve to restrict the AEC's options. In short, to postpone action is, for all practical purposes, to deny it. See FPC v. Hunt, 376 U.S. 515, 526 (1964) and City of Pittsburgh v. FPC, U.S. App. D.C. , 237 F. 2d 741 (1956).8/

It is for this reason that the AEC must not only immediately act upon the data obtained from the preparation of the detailed environmental statement with respect to plants under construction but must also issue with respect to these plants an order to show cause why the construction of the plant should not be suspended during preparation of the environmental statement.

A number of courts have been asked to apply NEPA to projects which began prior to January 1, 1970 but for which further federal action was required. In these cases the courts have not only found that NEPA was applicable but have ordered work on the projects halted until there had been full compliance with NEPA. Thus in Sierra Club v. Laird (D. Aug, June 23, 1970) ____ F. Supp. ____ (Appeal filed in the U.S. Court of Appeals for the Ninth Circuit) the court

8/ In Cities of Statesville, et al. v. AEC, ____ U.S. App. D.C. ____, ____ F. 2d ____ (1969) this Court discussed how the cost of producing nuclear power effects the liklihood that such power will become commercially viable. When the need to provide environmental protection is added to this cost-benefit analysis, it can be seen that the greater the cost of environmental protection the less likely it is that the protection will be deemed necessary. The fact is that nuclear fission as a source of power generation at its present state is only marginally economical. Congressional legislation was required to force the AEC to even find that such power has practical value. See Publ. Law 91-560 and S. Rep., No. 91-1247, 91st Cong., 2nd Sess.

granted a preliminary injunction to restrain defendants from continuing channel clearing work on the Gila River because such work had been undertaken without compliance with NEPA. In Environmental Defense Fund, Inc. v. U.S. Army Corps of Engineers (D.D.C., January 15, 1971) _____ F. Supp. _____ the Court issued a preliminary injunction to halt construction of the Cross-Florida Barge Canal, a project which was authorized in 1942 and for which construction began in 1964, on the ground that the Corps had not complied with the requirements of NEPA. See also Wilderness Society v. Hickel (D.D.C., April 23, 1970) where the Court issued a preliminary injunction to prevent issuance of permits to construct the Trans-Alaska Pipeline because the Department of Interior had not complied with NEPA and Texas Committee on Natural Resources v. U.S. (W.D. Tex., February 5, 1970) _____ F. Supp. _____ where the petitioners sought to prevent payment of a loan by the Farmers Home Administration for construction of a golf course on the ground that the construction would cause substantial damage to the environment and the Court issued an order staying the grant of the loan pending an appeal because the passage of NEPA subsequent to the Court's decision made the likelihood of success on appeal substantial.

In the instant case petitioners do not seek an order from this Court or the AEC halting construction of these nuclear plants. Petitioners merely seek a show cause hearing at which evidence will be presented by the applicant (who carries the burden of proof) and by environmentalists from which evidence the AEC will determine whether

the applicant has established that continued construction of its nuclear power plants will best serve the public interest. This determination will occur before the detailed environmental statement has been prepared and will require the AEC to weigh the possible irreversible environmental damage to be caused by continued construction against the evidence presented by applicant of a need for haste in the construction of the plant.

The Calvert Cliffs' Nuclear Power Plant is an excellent case in point for the application of the principles discussed above. A construction permit for that plant was issued on June 30, 1969, after a full hearing by the AEC. Jt. App. (Vol. II), 11. The hearing did not and could not include consideration of non-radiological environmental affects of the proposed plant. The proposed plant has been the subject of numerous studies conducted by state and federal authorities and by the applicant Baltimore Gas and Electric Company. The plant has received permits from the U.S. Army Corps of Engineers, the Maryland Department of Water Resources, 9/ the Maryland Public

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9/ One of the conditions imposed by the Maryland Department of Water Resources is that radioactive releases from the plant must not exceed 1% of the present AEC standards for acceptable releases (10 CFR, Part 20). In light of the recent decision by the District Court in Minnesota (_Northern States Power Company_ v. _State of Minnesota_, ____ F. Supp. ____)(decided December 22, 1970), declaring such limitations invalid it is doubtful that the Calvert Cliffs plant represents a satisfactory proposal to the Department of Water Resources.

Service Commission [10] as well as the AEC (See Jt. App. (Vol. II) 180 for a list of all permits required). Despite this impressive history of investigation of the Calvert Cliffs plant and the impressive list of permits granted to Baltimore Gas and Electric it was the conclusion of one of the most thorough reports prepared with respect to the plant that (Report to the Maryland Academy of Sciences by the Study Panel on Nuclear Power Plants (January, 1970)):

> In particular, we of the panel deplore the fact that the nuclear power station being built by the Baltimore Gas and Electric Company at Calvert Cliffs was sited and designed, at least in general terms, before any such survey [of the environmental impact of the plant] was made. We recognize that a long lead time is necessary for planning construction of such magnitude, but this very fact underlines the urgency of anticipating future developments. [brackets added]
>
> The panel gave careful attention to the plans for the Calvert Cliffs generating plant and to many aspects of its possible influence on the environment. We recognize that there are many areas in which further research is needed - these are described later in the report - but based upon the best information available at this time concerning the expected biological, chemical and physical

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10/ One of the conditions imposed by the Public Service Commission is that the plant must be backfitted with technological advances that will provide reasonable additional protection necessary for public health and safety and protection of the environment. The AEC has rejected the imposition of such a condition and the recent decision in Northern States Power Company v. State of Minnesota, supra, suggests that the more stringent state standard may be invalid. In addition the Public Service Commission also requies that the plant be operated in conformity with the Water Resources permit and its stringent limitations on radioactive releases. If those limitations are invalid the Public Service Commission may then decide to reconsider its decision to issue a permit.

> impact of the Calvert Cliffs plant in normal operation, we have concluded that, in all probability, the plant will not of itself represent a major environmental threat. It was evident at the outset that in the specific question of Calvert Cliffs, there were only two possible alternatives to be considered by the panel - either to recommend that the State of Maryland act to prevent operation of the plant, or to recommend that the State give conditional approval for the ultimate operation of the plant, subject to appropriate guarantees and monitoring. Only after careful consideration have we resolved on the latter.
>
> * * * *
>
> In summary, the panel looks upon the Calvert Cliffs nuclear power plant as an experimental took, one purpose of which is to provide information allowing assessment of the impact of the nuclear power industry upon the environment.

The fact is that the Calvert Cliffs plant is being constructed with very little information about its probable impact on the environment of Chesapeake Bay. There are substantial unanswered questions regarding the oceanography of the Bay. (Summary of Presently Known Facts About the Environmental Impact of the Calvert Cliffs Nuclear Power Plant on Chesapeake Bay prepared by Beth Beegle (5-6) (Jt. App. (Vol. II), 107-108) (hereinafter Beegle Summary)); the impact of temperature on the sea and wildlife of the Bay (Beegle Summary (17-19) (Jt. App. (Vol. II), 123-125)); the effect of taking large quantities of water into and through the plant where the water is subjected to substantial increases in temperature and the addition of chemicals and minerals (Beegle Summary (21-24) (Jt. App. (Vol. II), 147-156)). Most authorities have conceded that much more information is required to assess the environmental

impact of the plant and extensive studies have been ordered (Beegle Summary (24-26, 37-38) (Jt. App. (Vol. II), 130-132, 145-146). All of those studies are being made in the face of the inexorable construction of the plant.

The general knowledge about the effect on the fish, birds and other organisms which exist on Chesapeake Bay near the Calvert Cliffs site (Beegle Summary (19-31) (Jt. App. 125-137)) all suggests that the massive alteration in the water flow and water composition at the plant site as well as the continuous and wide ranging discharge of heated and radioactive water will have an adverse effect on the environment. In general the fish and other sea life of the Bay will probably suffer from the fact that the plant will discharge high salinity, low oxygen, high temperature water taken from the lower depths of the bay and discharged in the upper waters of the Bay where oxygen is high and salinity is low. (Beegle Summary (14-17, 27-36) (Jt. App. (Vol. II), 120-123, 133-144)). The plant will move 5,600 cubic feet of salt water every second (3,450,000,000 gallons per day) and return it to the lower salinity upper water of the Bay after heating the water 8°. (Beegle Summary (10-12) (Jt. App. (Vol. II), 113-115)). This quantity of water represents more than half the daily flow of the Susquehanna River, the largest source of fresh water to the Bay. (Beegle Summary (10) (Jt. App. (Vol. II, 113)).

The Calvert Cliffs plant represents an unknown quantity in the future of the environment of the Chesapeake Bay. It is aptly described by the Maryland Academy of Sciences Report, supra, as an "experimental tool". But with the passage of NEPA federal agencies are prohibited from continuing to allow such experiments with our decaying environment. In its report on NEPA the Senate Committee on Interior and Insular Affairs observed (S. Rep. No. 91-296, 91st Cong., 1st Sess., pp. 16-17): 11/

> Past neglect and carelessness are now costing us dearly, not merely in opportunities as foregoine, in impairment of health, and in discomfort and inconvenience, but also in a demand upon tax dollars upon personal incomes, and upon corporate earnings. The longer we delay meeting our environmental responsibilities, the longer the growing list of "interest charges" in environmental deterioration will run. The cost of remedial action and of getting on to a sound basis for the future will never again be less than it is today.

In fact, former Senator Tydings of Maryland urged enactment of an amendment to the Atomic Energy Act of 1954 to expand the AEC jurisdiction to consider non-radiological environmental factors precisely because of the inadequacy of the existing knowledge on the environmental impact of the Calvert Cliffs plant. Hearings before the Joint

---

11/ See also 115 Cong. Rec. (Daily Ed.) S. 17451 (December 20, 1969) where Senator Jackson, the Chief Senate Sponsor of NEPA stated:

> "too much of our past history of dealing with environmental problems has been focused on efforts to deal with 'crises', and to 'reclaim' our resources from past abuses."

Committee on Atomic Energy on Prelicensing Antitrust Reveiw of Nuclear Power Plants (91st Cong., 1st Sess., November 18, 19 and 20, 1969), p. 13-15. The Joint Committee ultimately concluded that the passage of NEPA and the Water Quality Improvement Act of 1970 made it unnecessary to give further consideration to Senator Tydings proposal. S. Rep. No. 91-1247, 91st Cong., 2nd Sess., p. 4.

Thus, in the case of the Calvert Cliffs plant it can be seen that a full investigation of the adverse environmental effects of the plant is absolutely essential. Many important issues have not been answered. However, if construction continues while these questions are being investigated and if the AEC in any event postpones imposition on the plant of conditions to protect the environment until the hearing on the operating license (some 2 years from now) the major investment in the plant design and the commitment to use this plant as a source of power will be so great that few if any changes will be deemed feasible alternatives and a potential disastrous project will proceed with its environmental experiment on one of the richest and largest estuaries in the United States.

These problems are intensified by the refusal of the AEC to impose on the Calvert Cliffs plant and all other plants a requirement that as technological advance occurs the plants should be backfitted with new components if there will be substantial additional protection of the environment. The AEC has found that its obligation to provide

for health and safety requires the imposition of a condition for backfitting (10 CFR, Part 50, Section 50.109 adopted March 31, 1970 (35 Fed. Reg. 5317)). It is difficult to comprehend why its new obligations under NEPA do not require as much. The AEC has not provided for environmental protection to the "fullest extent possible" if it does not extend the backfitting obligation to cases of environmental protection.

Actually, with the enactment of NEPA and the increasing awareness of environmental problems great strides in the technology of environmental protection can be expected in the near future. Surely the unavoidable adverse effects of nuclear power plants should not be made a permanent part of our environment if subsequent technology makes it possible to avoid them.

Conclusion

For the reasons stated above the petitioners should be granted the relief to which they are entitled by the National Environmental Policy Act.

Respectfully submitted,

BERLIN, ROISMAN AND KESSLER
Counsel for Petitioners

By Anthony Z. Roisman
Anthony Z. Roisman

February 16, 1971

IN THE

UNITED STATES COURT OF APPEALS

FOR THE DISTRICT OF COLUMBIA CIRCUIT

CALVERT CLIFFS' COORDINATING COMMITTEE, INC.
NATIONAL WILDLIFE FEDERATION, and
THE SIERRA CLUB,

Petitioners,

v.

U.S. ATOMIC ENERGY COMMISSION,
UNITED STATES OF AMERICA,

Respondents.

No. 24,839

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing Motion for Leave to File a Brief in Typewritten Form and the Brief of Petitioners and the Joint Appendix (Vol. II) were hand delivered to representatives of the following:

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Washington, D. C.
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this 16th day of February, 1971.

Anthony Z. Roisman

24, 839

ENVIRONMENTAL ADDENDUM II

Environmental Report

Calvert Cliffs
Nuclear Power Plant

Baltimore Gas and Electric Company
Baltimore, Maryland

ENVIRONMENTAL REPORT

CALVERT CLIFFS NUCLEAR POWER PLANT

BALTIMORE GAS AND ELECTRIC COMPANY
BALTIMORE, MARYLAND

NOVEMBER 16, 1970

TABLE OF CONTENTS

Section		Page
	Preface	iv
	Commitment	vii
1.0	INTRODUCTION	1
1.1	Statement of Project	1
1.2	Purpose of Statement	4
2.0	ENVIRONMENTAL IMPACTS	5
2.1	General	5
2.2	Thermal Effects	6
2.3	Radiological Effects	25
2.4	Chemical Releases	39
2.5	Physical Presence	40
2.6	Other Impacts	46
3.0	POSSIBLE ADVERSE EFFECTS	49
4.0	ALTERNATES TO THE PROPOSED ACTION	50
4.1	Not Providing the Power	51
4.2	Importing Power Instead of Generating It in Central Maryland	51
4.3	Building a Fossil-Fuel-Fired Plant in Lieu of a Nuclear Plant	52
4.4	Using Gas Turbines in Lieu of a Steam Electric Plant	53
4.5	Possible Cooling Alternatives	53
4.6	Site Alternatives	60
5.0	RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT	62
6.0	IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES	64

TABLE OF CONTENTS (Cont.)

Appendix			Page
A		DESCRIPTION OF CALVERT CLIFFS SITE	A-1
	A.1.0	Location	A-1
	A.2.0	Population Characteristics	A-4
	A.3.0	Land Use Characteristics	A-8
	A.4.0	Geology	A-9
	A.5.0	Ground Water Hydrology	A-10
	A.6.0	Oceanography	A-12
	A.7.0	Meteorological Characteristics	A-17
B		DESCRIPTION OF PLANT EFFLUENT AND WASTE SYSTEMS	B-1
	B.1.0	Condenser Cooling Water System	B-1
	B.2.0	Radioactive Waste Processing Systems	B-10
	B.3.0	Other Effluents	B-14
C		DESCRIPTION OF ENVIRONMENTAL STUDIES	C-1
	C.1.0	Marine Environment Studies	C-1
	C.2.0	Radiological Monitoring Program	C-10
D		POSSIBLE EFFECTS OF ACCIDENTAL RELEASES	D-1
E		PERMITS REQUIRED FROM LOCAL, STATE, AND FEDERAL AGENCIES	E-1
	E.1.0	Calvert County Regulatory Agencies	E-1
	E.2.0	State Regulatory Agencies	E-2
	E.3.0	Federal Regulatory Agencies	E-5

LIST OF ILLUSTRATIONS

Figure No.	Title	Page
1.1-1	Calvert Cliffs Nuclear Power Plant Simplified Flow Diagram	3
2.5-1	Photograph of Site	42
2.5-2	Architectural Model of Power Plant Building	43
2.5-3	Plant Construction Photograph - October 6, 1970	44
A.1-1	Site Vicinity	A-2
A.1-2	Site Plot Plan	A-3
A.7-1	Regional Map	A-21
A.7-2	Meteorological Instrumentation Location Map	A-22
A.7-3	Location of Meteorological Stations	A-27
A.7-4	Relative Concentrations as a Function of Distance from Release Point	A-31
A.7-5	Average Annual Venting Relative Concentration	A-32
B.1-1	Circulating Water System - Sheet 1	B-4
B.1-2	Circulating Water System - Sheet 2	B-5
B.1-3	Circulating Water System - Sheet 3	B-6
B.1-4	Circulating Water System - Sheet 4	B-7
C.2-1	Environmental Radiation Sampling Stations	C-11

PREFACE

The health, stability and economic security of both the State of Maryland and the Baltimore Gas and Electric Company are undeniably linked to the health and stability of their natural surroundings. Maryland's natural treasures range from the beaches of the Atlantic Ocean to the mountains and lakes in the west, but none is so critically important as the Chesapeake Bay.

As an estuary, the Chesapeake is a meeting place between fresh water and salt water, between the river and the ocean, between man with his industrialized civilization and nature with her spawning areas for anadromous fish and resting places for migratory birds. Man's uses of the Bay and nature's uses of the Bay must co-exist in harmony. With proper resource management, these sometimes divergent uses can co-exist. We believe that the Calvert Cliffs Nuclear Power Plant is a case in point and that there are many reasonable assurances to indicate that the plant and the Bay will be compatible, and that this use by man will not upset nature's balance.

The Chesapeake Bay in the general vicinity of the Calvert Cliffs plant site is also utilized for navigation, recreation and commercial fisheries. Major shipping channels pass by the site. Boating and sportfishing are popular recreational activities. Oysters, crabs and finfish are taken commercially from the area. Finfish important to both sport and commercial fishermen include striped bass, spot, bluefish, drum, perch, black bass, sea trout, shad and many others; alewives (menhaden) are taken in large quantities and processed for fish oil and fertilizer. This area of the Bay also provides resting and feeding grounds for geese, ducks, swan and many other birds, including gulls, terns and predatory fowl.

Except for occasional occurrences of noxious conditions such as red tides, conditions for fish in the plant area appear healthy. The diversity of species is normal for the western shore. Flora and fauna components of the food chain are diverse although affected some by organic enrichment as evidenced by the common occurrence of blue green algae and lower than expected numbers of species and species population of protozoan fauna. The macroscopic invertebrate fauna is healthy with a broad diversity of organisms present. All things considered, the marine life in the Bay at the plant site is normal and healthy.

The topography of the Calvert Cliffs site is of great natural interest with the rolling characteristic of the land formation one of its most pleasing aspects. On the Bay frontage and along interior streams, there are near-perpendicular walls caused by water, wind and frost action. The site has a variation in elevation from sea level to about 137 feet. The Cliffs of Calvert are world famous for their rich deposits of Miocene Period fossils.

The woodlands on the site are typical of southern Calvert County. Red and White Oaks, Hickories, Tulip Poplars, Red Maples, Virginia Pines and Gum trees make up the bulk of the forest. Two or three communities of Beeches are clustered along streams and near the Bay. American Hornbeam, Dogwood and Sassafras are in good supply. Almost impassable thickets of Mountain Laurel and American Holly are found in most of the stream valleys. Wildflowers are in great abundance along the edges of the fields.

The land animals on the site include White-Tail Deer, Red and Grey Fox, Racoon, Grey Squirrel, Eastern Chipmonk and Rabbits.

These wonders of nature will be largely preserved intact on more than half of the 1135 acres in the Calvert Cliffs site. Other sections of the site that are currently supporting construction activities will be returned to nature or to farming as appropriate. About 150 acres were under active cultivation when the site was acquired, and it is expected that at least this much acreage or more will continue to be farmed in the future.

The Baltimore Gas and Electric Company recognizes that the Chesapeake Bay and the land environment at the Calvert Cliffs site are valuable resources and that every effort must be made to preserve these assets for the use and enjoyment of future generations.

COMMITMENT

A major corporate commitment has been made to design, construct and operate the Calvert Cliffs Nuclear Power Plant so that it will have no significant adverse effects on the environment. In addition to the care and attention that is documented in this Environmental Report, the Baltimore Gas and Electric Company also makes the following commitments:

1. The Calvert Cliffs Nuclear Power Plant will be operated in strict accordance with all applicable regulations including the Operating License to be issued by the Atomic Energy Commission and the permits issued by the Maryland Department of Water Resources.
2. The Company will cooperate to the fullest extent possible with all local, State and Federal agencies in establishing and conducting all pre- and post-operational environmental programs, dealing with radiological, thermal and other potential effects.
3. The Company will distribute data and reports obtained from its marine ecology studies, marine environmental surveillance programs and radiological monitoring programs to all pertinent local, State and Federal agencies.
4. The radioactive waste processing system will be operated to maintain discharges as low as practicable.

5. If the post-operational environmental surveillance programs indicate that the fish and wildlife resources of the area are being damaged as the result of plant operation, the Company will make modifications in equipment or operations to correct the cause of the damage.

1.0 INTRODUCTION

1.1 Statement of Project

By application dated January 25, 1968, and ten amendments thereto, the Baltimore Gas and Electric Company applied to the U.S. Atomic Energy Commission for a license to construct a two unit nuclear power plant to be known as the Calvert Cliffs Nuclear Power Plant, Units 1 and 2, on a site in Calvert County, Maryland. The Division of Reactor Licensing of the Atomic Energy Commission, the Advisory Committee of Reactor Safeguards, the Atomic Safety and Licensing Board (including a public hearing in Prince Frederick, Maryland, on May 12 and May 13, 1969) and the Atomic Energy Commission itself each independently reviewed the plant design, and the Atomic Energy Commission subsequently issued Construction Permits Nos. CPPR-63 and CPPR-64, dated July 7, 1969. The two unit plant will occupy part of an 1135 acre site on the western shore of the Chesapeake Bay about 11 miles south of Prince Frederick. The Bechtel Corporation has been retained as the architect-engineer and constructor. The NUS Corporation has been assisting the engineering and environmental staff of the Baltimore Gas and Electric Company in general nuclear and environmental matters. Experts in meteorology, radiological physics, marine biology, nuclear fuel technology, quality assurance, engineered safeguards and other specialized disciplines have been retained for supplementary assistance.

Unit No. 1 is scheduled for start-up in mid-1972 and regular operation in early 1973. Unit No. 2 is scheduled for similar operation one year later. In preliminary information releases, the

nominal net electrical plant output of each unit has generally been listed as "more than 800 megawatts." Final design has resulted in the following ratings for each unit:

	Guaranteed	Maximum-Expected
Nuclear Steam Supply System	2570 Mwt	2665 Mwt
Gross Generator Output	880 Mwe	910 Mwe
Net Plant Output	845 Mwe	875 Mwe

Both of the Calvert Cliffs units will utilize identical pressurized water reactors which are being designed and fabricated by Combustion Engineering, Inc. The No. 1 Unit turbine-generator will be furnished by the General Electric Company, and the No. 2 Unit turbine-generator will be furnished by the Westinghouse Electric Corporation. Both turbine-generators will be similar in type and construction and will have similar performance characteristics.

Each electrical generating unit of the Calvert Cliffs Nuclear Power Plant will have three separate water loops as shown in Figure 1.1-1. The first or primary coolant loop is a closed piping system, and it is through this loop that the pressurized water is circulated. The water in this primary loop moderates the fissioning process and transfers the heat, generated by this process, from the reactor to the steam generators. The secondary loop is also a closed piping system. It is in this loop that the steam from the steam generators is passed through the turbine and upon leaving the turbine is condensed back to water and returned to the steam generators. The third loop is an open system where water from the Chesapeake Bay is passed through the plant's condensers and then returned to the Bay. This cooling water provides the means for condensing the spent steam leaving the turbine (second loop).

CALVERT CLIFFS NUCLEAR POWER PLANT
SIMPLIFIED FLOW DIAGRAM

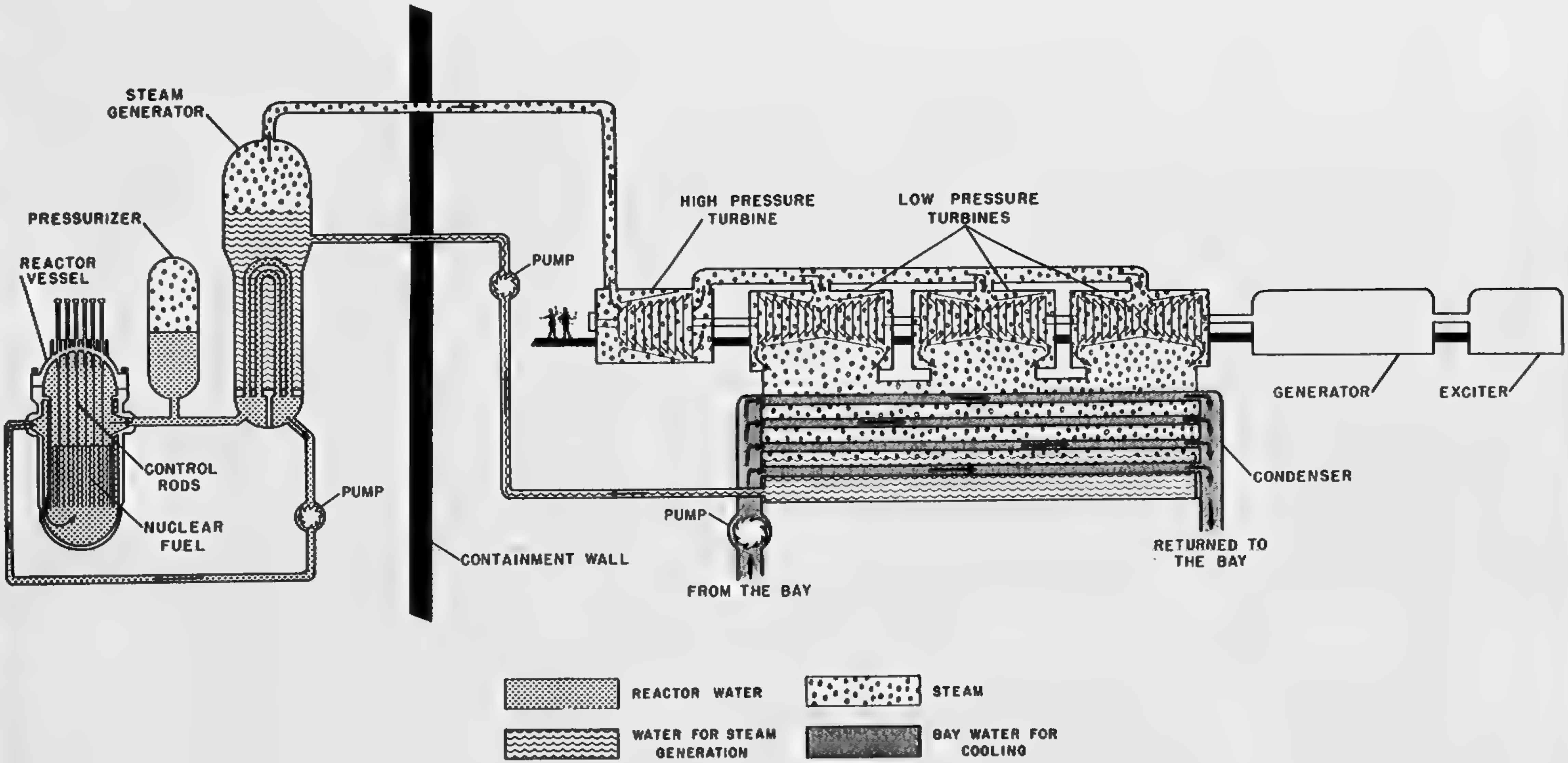

FIGURE 1.1-1

In addition to the condenser cooling water, a much smaller quantity of Bay water will be used for cooling various auxiliary systems in the plant. In all these systems, the Bay water will cool water contained in an intermediate closed piping system which, in turn, cools plant auxiliary equipment; thus providing for physical separation between the Bay water and the plant equipment.

The Department of Water Resources has issued a Surface Water Appropriation Permit No. C-70-SAP-1 dated July 15, 1970, which authorizes use of Chesapeake Bay water for cooling purposes and Waterway Construction Permit No. C-70-CI-12 dated July 15, 1970, which authorizes dredging of intake and discharge channels and the construction of related offshore structures.

Units 1 and 2 which are scheduled for commercial service in early 1973 and in early 1974, respectively, will provide additional base-load generating capacity required to enable the Applicant to meet load conditions and reserve requirements projected for those years.

1.2 Purpose of Statement

This statement was prepared by the Applicant at the requests of the Department of the Army, Corps of Engineers, pursuant to the provisions of Section 13 of the River and Harbor Act of 3 March 1899 and Section 102 (2)(c) of the National Environmental Policy Act of 1969 and the AEC's Division of Reactor Licensing in response to the proposed Appendix D to Part 50 for implementation of the National Environmental Policy Act of 1969.

2.0 ENVIRONMENTAL IMPACTS

2.1 General

It has always been a corporate objective of the Baltimore Gas and Electric Company to protect the environment from the effects of electric generation. The generation of electricity, by whatever means, inherently has some effect upon the environment. Careful design and the selection of the proper equipment can minimize these effects, while at the same time providing the electric energy our civilization requires. As electric generating plants get larger, as population density increases, as the social consciousness of the people demands cleaner air and purer water, the design of these plants becomes even more important.

In recognition of the increasing problems of our industrialized society, the Baltimore Gas and Electric Company has dedicated itself to consider, evaluate and minimize, to the best of its ability, the impacts of its installations and operations upon the environment. The Company welcomes the active participation of all local, State and Federal agencies serving the people.

In meeting this responsibility, the Company, before initiating a major project such as Calvert Cliffs, asks itself and searches for answers to the following types of questions:

1. Who should participate in formulating the assumptions and conclusions about the choice of plants or sites?
2. What lasting benefits will be produced? Who will derive those benefits?

3. Will any environmental problems be created?

4. What are the alternatives?

The Calvert Cliffs Nuclear Power Plant will have the following impacts upon the environment.

2.1.1 It will pump through the plant's condensers and discharge in a slightly heated condition a small fraction of the Chesapeake Bay water available in the area; the time of transit through the plant will be less than four minutes, the design temperature rise at maximum expected capacity will be 10 degrees Fahrenheit (5.5° C).

2.1.2 It will release at various intervals and under complete control small quantities of radioactive materials to the air and water, in concentrations considerably less than those permitted in comparable plants.

2.1.3 It will release at various intervals and under complete control small quantities of miscellaneous compounds from laboratory drains, corrosion inhibitors, water treatment, cleansing compounds, etc., in concentrations considerably less than those permitted in other installations.

2.1.4 It will impact in the same way as any other large facility by its very physical presence; the increased traffic, noise, workmen, access roadway, associated structures and activities.

2.1.5 It will impact by its use of the land.

These and other impacts are examined in detail in Sections 2.2 through 2.6.

2.2 Thermal Effects

The distribution and magnitude of temperatures in the receiving waters in excess of the natural temperatures depends on the amount of heat picked up by the condenser cooling water, the volume of

condenser cooling water flow and temperature rise, the design of the intake and discharge structures, the amount of new water available for mixing with the heated discharge water, the currents and circulation patterns, and the rate of loss of excess heat to the atmosphere.

Information needed to design the condenser cooling water system to meet State and Federal water quality standards and to minimize thermal and other effects which might be detrimental to the aquatic life was obtained through investigations made in four general areas. These investigations included checking the heat assimilative capacity of the Chesapeake Bay in the vicinity of the plant site, determining the physical characteristics of the Bay, selecting design criteria for protection of the marine ecology, and predicting the distribution and magnitude of excess temperatures to be expected during plant operation.

2.2.1 Heat Assimilative Capacity of Chesapeake Bay

One of the great assets of the Calvert Cliffs site is the abundance of water available for cooling purposes. The Chesapeake Bay is six miles wide at this point. The movement of tidal waters is quite large. The maximum tidal flow is about 1,500,000 cfs and the average flow 800,000 cfs which is 150 times the quantity of cooling water which will be circulated through the condensers. The length of a tidal excursion in the vicinity of Calvert Cliffs is about six miles. Dr. Donald W. Pritchard, Director of the Chesapeake Bay Institute of The Johns Hopkins University, has calculated that if all the waste heat from the plant were mixed into the surface layer of the tidal segment adjacent to the plant, and none of this excess heat were transferred into adjacent tidal segments up the Bay or down the Bay from the site, that the rate of heat loss to the atmosphere would limit the average

excess temperature in the surface layer of the tidal segment to 1.3 F.

Investigations by the Chesapeake Bay Institute have determined that there is a non-tidal circulation pattern superimposed on the flood and ebb cycle of the tidal currents. This non-tidal flow, caused by fresh water river flows and vertical salinity variations, is two-layered in the stretch of Bay near Calvert Cliffs. There is a seaward flow of relatively fresh water in the upper layers and a lesser flow of ocean water directed up the estuary in the deeper layers. These non-tidal currents are approximately one-fifth the strength of the tidal currents. The higher-salinity water that moves up the Bay in the lower layers gradually diffuses upward, mixing with the fresher water in the upper layers, and returns to the ocean, thus preserving the flow balance in the Bay.

Using a segmented mathematical model involving volume continuity equations, Dr. Pritchard has calculated values for these non-tidal flows. He has determined that in the tidal segment of the Bay adjacent to the plant site, the non-tidal flow is 90,000 cfs. This is new water available for dilution of the heated cooling water discharge. The flow of new water depends on the volume rate of inflow of fresh water and the time rate of change of salinity above any segment in question. It is significant that when tributary flow decreases, flow up the Bay from the ocean increases. For this reason the available dilution water at any point in the estuary remains fairly constant and is relatively independent of river flow. The water to be used for cooling by the Calvert Cliffs Nuclear Power Plant (5,400 cfs), therefore, amounts to only about six percent of the new water available for dilution throughout the entire year.

Taking into account the new water available for dilution, Dr. Pritchard has estimated that the average excess temperature in the surface layer of the plant's tidal segment will be lowered from the 1.3 F temperature previously stated to 0.4 F. (1) It is, therefore, apparent that the heat assimilative capacity of the plant's tidal segment will not be taxed by the cooling water discharges. In fact, there is every reason to believe that there is sufficient cooling water adjacent to the Calvert Cliffs site to support future capacity additions. Dr. Pritchard has also computed thermal distributions to produce what he considers a comparative prediction of the proper excess temperature distribution in the Chesapeake Bay adjacent to the site of the Calvert Cliffs plant. The results of this mathematical analysis are shown in Table 2.2.1.

Furthermore, hydraulic models can be used to accurately forecast flow dynamics, dispersion and distribution patterns of excess temperature in the vicinity of the plant. Such a model was built and operated for the Calvert Cliffs Project by the Alden Research Laboratories and is discussed in Section 2.2.4.

2.2.2 Physical Characteristics of Chesapeake Bay

Sheppard T. Powell Associates was retained in mid-1967 to assemble data on the physical characteristics of the Chesapeake Bay in the vicinity of the Calvert Cliffs site. Preliminary surveys were

(1) Nuclear Power Plants in Maryland - Governor's Task Force on Nuclear Power Plants - December 1969.

TABLE 2.2.1 (1)

Best Estimate, Distribution of Excess Temperature in the Chesapeake Bay Adjacent to the Calvert Cliffs Nuclear Power Plant, Resulting from the Discharge of Condenser Cooling Water at a Flow Rate of 5400 Cfs, and a Temperature Elevation of 10°F (i.e., Heat Rejected at the Condensers = 12.1×10^9 BTU Hr^{-1})

Excess Temp. (°F)	Longitudinal* Dimensions (Feet)	Lateral** Dimensions (Feet)	Horizontal Area (ft^2)	Horizontal Area (Acres)
5	1.0×10^3	2.5×10^2	2.5×10^5	5.6
3	2.0×10^3	5.0×10^2	1.0×10^6	23
2	4.0×10^3	1.0×10^3	4.0×10^6	92
1	1.0×10^4	4.0×10^3	4.0×10^7	920
0.5	3.0×10^4	1.5×10^4	4.5×10^8	10,330

*Length of the area having excess temperature equal to or greater than the specified value, along a line approximately parallel to the shore line.

**Width of the area having excess temperature equal to or greater than the specified value, along a line approximately perpendicular to the shore line.

(1) Nuclear Power Plants in Maryland - Governor's Task Force on Nuclear Power Plants - December 1969.

conducted shortly thereafter to develop temperature and salinity profiles. Also, a great quantity of pertinent data was obtained from various State and Federal agencies, including the Department of Water Resources, Chesapeake Bay Institute, Natural Resources Institute, Department of Chesapeake Bay Affairs, Chesapeake Field Station of the Federal Water Pollution Control Administration, Naval Research Laboratory at Chesapeake Beach, and the U.S. Coast and Geodetic Survey.

These preliminary data served as a basis for the establishment of a detailed investigative program that started in the spring of 1968. Eight reference floats, which served as survey stations of known locations, encompassing an area of almost one square mile, were permanently anchored on the Bay near the site. Pinpoint locations of the reference floats were obtained by aerial photography. Data to construct profiles of water temperatures, salinity concentrations and dissolved oxygen concentrations were taken at the floats.

In addition, a recording instrument station was established in the spring of 1968 to obtain a continuous record of water temperature and to collect water samples for salinity analysis at depths of 5, 20, and 35 feet. Later, measurements of dissolved oxygen concentrations at these depths were added to the data record obtained at the station. This floating Hydrographic Field Station was located about 1¼ miles offshore from the plant site in about 40 feet of water.

Data from the Hydrographic Field Station showed that there is a sharp increase in the density of the water column in the 25- to 35-foot depth range during the summer months as a result of temperature and salinity stratification.

The salinity concentration which averages about 15,000 ppm, or about half that of ocean water, increases vertically in a typical halocline distribution. The salinity increases at a low rate down to a depth of about 25 feet, then increases at a rapid rate in the 25- to 35-foot depth range, and again at a low rate in the deeper waters. The variation in salinity concentration between the surface and the 35-foot depth reaches a maximum of about 5,000 ppm in the late spring and a minimum of 1500 to 2000 ppm in the fall.

Water temperature in the Chesapeake Bay generally develops into the same type of vertical distribution during the summer as salinity, exhibiting a sharp and definite thermocline between an upper layer of warm water and a lower layer of cooler water. The thermocline develops at the start of warm weather in the spring and continues to become sharper and more pronounced throughout the summer. During 1968 and 1969, the thermocline was found to range between the 25- to 40-foot depths.

In developing the basic design parameters for the Calvert Cliffs cooling water system, it appeared that the existence of a sharp thermocline during the warmest time of the year could be used as a temperature advantage if cooling water could be extracted from beneath the thermocline and discharged above it. In the summer of 1968, this temperature advantage ranged between 5 and 15 F. During 1969, which exhibited a summer of unusually cool water temperatures, the advantage generally ranged between 3 and 8 F. A maximum surface water temperature of 86.5 F was observed several times during 1968. During 1969 the maximum surface water temperature was 86.0 F and this level was reached only once the entire year.

Data taken at the Hydrographic Field Station also revealed that the dissolved oxygen concentration varied considerably with the time of day and the weather conditions. Generally, concentrations on the surface were near saturation values in the early and mid-summer but exhibited a supersaturation in the late summer and early fall due to the photosynthetic activity of an increased population of algae and other plant life. Concentrations at the bottom generally were near zero and in one instance oxygen content was observed to be zero. Rapid increases in concentration at the bottom occurred when turbulent weather conditions caused vertical mixing of the water column. It was recognized quite early that if the deep, cool, oxygen deficient, highly saline water was to be used for condenser cooling purposes, consideration would have to be given in the design of the discharge to provide for rapid mixing with oxygen-rich waters to avoid possible harmful effect to the aquatic life in the surface waters.

2.2.3 Design Criteria for Protection of Marine Ecology

Dr. Ruth Patrick, Chairman of the Department of Limnology of the Academy of Natural Sciences of Philadelphia, provided design criteria for the once-through cooling water system prepared for Calvert Cliffs so as to produce as little change as possible in the eco-system of the Bay. The principal criteria which were adopted for the system are as follows:

1. Condensers should be designed so that the temperature rise in the cooling water which passes through them is as low as practicable. This will avoid subjecting entrained organisms to temperatures above their thermal damage threshold and will minimize thermal shock.

2. The cooling water intake to the plant should draw as much water as possible from below the photosynthetic zone to minimize the number of plankton and other microscopic organisms that are pumped through the plant's cooling system.

3. The intake velocity of the cooling water to the plant should be low enough to avoid disturbance of the schooling and swimming patterns of fish and to permit ease of egress for those fish that swim into the intake basin.

4. The cooling water system design should utilize mechanical equipment to clean condenser tubes to minimize the use of biocides for fouling control.

5. The point of discharge of the cooling water should be located far enough out from the shore so as not to disturb the current patterns and temperature regimes of the shallow water areas and should provide ample opportunity for mixing of the warmed cooling water with the receiving waters.

6. The cooling water discharge should be designed to create a high velocity jet to induce rapid mixing with the receiving waters to minimize changes in natural temperatures, oxygen content and salinity.

7. The cooling water discharge should be designed to minimize the time at which the maximum temperature elevation exists. Short exposure times as well as a minimum temperature rise are important in protecting the aquatic life.

2.2.4 Prediction of Excess Temperature Distribution

In an early design decision it was decided that the condenser cooling water should be discharged as a momentum or high-velocity jet to obtain rapid dilution of excess temperature, low-oxygen water and salinity as called for by the criteria that had been established for the protection of the environment. Such a jet creates turbulence and entrains dilution water to bring the temperature and salinity down and oxygen content up quickly.

Dr. John C. Geyer, Chairman of the Department of Geography and Environmental Engineering at The Johns Hopkins University, has pointed out that there is not, at present, a satisfactory theory or mathematical model to describe the behavior of a nearshore, shallow-water momentum jet in a tidal cross-flow. The tide swings the plume back and forth. Entrainment withdraws water from behind the plume as the tide swings it sideways and may pull the plume right into shore. If by this or other means, warm water is circulated back into the plume, the temperature dilutions may be adversely affected. Winds at the surface, friction at the bottom, increase in depth offshore, and the location and arrangement of the discharge all influence the behavior of the plume of warmed water.

Hydraulic models can be used to provide a means for study of flow patterns in the areas of an estuary affected by heated cooling water discharges. Through such studies, predictions can be made regarding the excess temperature distribution which may be expected to result from use of a momentum jet.

Accordingly, it was decided in 1967 to sponsor the construction of a model of a section of the Chesapeake Bay to develop the

information needed for designing the intake and discharge structures for the Calvert Cliffs plant which would meet the requirements of Maryland water quality standards and the various criteria established for protection of the aquatic life of the area. The Alden Research Laboratories of Worcester Polytechnic Institute was selected to construct the model and to make this study.

In late 1968, in cooperation with the Board of Natural Resources, a Calvert Cliffs Nuclear Power Plant Model Advisory Committee, composed of three State representatives and three Company representatives, was established. The functions of the Committee were the following: (a) review of the testing program as proposed by the Alden Laboratory; (b) presentation of suggestions for modification of the testing program (such as the addition of temperature measuring points); (c) study and review of the results of the model tests as they became available, and (d) after study and review of all of the results of the model studies, preparation of a report briefly giving the Committee's consensus as to the degree of validity of the final predictions, made from the model results, of the probable temporal and spatial distribution of excess temperature in the Chesapeake Bay off the plant site.

The members of the Committee are as follows:

<u>State Representatives</u>

Dr. L. Eugene Cronin, Secretary	-	Director, Natural Resources Institute, University of Maryland
Paul W. McKee	-	Director, Department of Water Resources, State of Maryland
Dr. Donald W. Pritchard	-	Director, Chesapeake Bay Institute, Johns Hopkins University

Company Representatives

Raymond C. Dannettel	-	Consulting Engineer
Dr. John C. Geyer, Chairman	-	Chairman, Department of Geography and Environmental Engineering, Johns Hopkins University
Prof. Lawrence C. Neale	-	Director, Alden Research Laboratories, Worcester Polytechnic Institute

It was necessary to build the model large enough to cover a 34-mile stretch of the Bay in order to include two tributaries whose flow affects currents in the plant vicinity. The model, scaled 1/1000 horizontally and 1/100 vertically, occupies nearly the entire space in a building 90 feet wide by 204 feet long. Tidal flows are reproduced automatically. Only 7.5 minutes are required to run through a complete 12.5 hour Bay tidal cycle.

Density similarity between the model and the Bay, including the power plant intake and discharge, was developed by holding all model water temperatures equal to the corresponding Bay water temperatures. The density effects due to temperature differences are properly represented as a result of the one-to-one temperature ratio.

Since the model studies were intended to provide a valid assessment of heat-transfer phenomena as well as mass-transfer phenomena, careful consideration was made of all forms of heat transfer. Solar and wind effects were essentially eliminated by enclosing the entire model in a building. Evaporative effects were minimized and controlled by maintaining the model environment at a relative humidity in excess of 90 percent. Convective heat transfer at the water-air interface was minimized by maintaining the model air temperature within about one

degree Fahrenheit of the base water temperature. For the purpose of recording the modeled Bay temperatures, environmental temperatures, and plant intake and discharge temperatures, 144 copper-constantan thermocouples were strategically located in the model.

Smaller models of 1/50, 1/100, and 1/250 undistorted scale were constructed adjacent to the main model to include the local area within a radius of 1000 feet from the plant site. These uniform scale models allowed the discharge jet-flow patterns and related intake flows to be studied in detail.

Adjustment of the model was based on field data to permit the comparison of the model with actual Bay behavior. Of particular importance were the velocity determinations throughout the modeled area. Correctly modeled velocities assure a valid model of the flow patterns for the full range of tides. Velocity data published by the United States Coast and Geodetic Survey in the 1968 Tidal Current Charts for the Upper Chesapeake Bay were used as a guide for initial model adjustment.

Further data was obtained through field determination of velocities at critical sections of the Bay. These velocities were measured by releasing drogues in the Bay and determining drogue movement by aerial photogrammetry. The drogues were constructed to measure velocities at the Water surface, at depths of 15 feet and at depths of 30 feet. Tests were made at several locations, including the model extreme limits and the area near the plant site for both ebb and flood tides.

When the performance of the model tide cycle indicated a good comparison with design flows and elevations, a series of model

drogue studies were conducted to provide a direct comparison with the respective field drogue studies. The model studies were accomplished by photographing, from overhead, the traces of candle floats released in the model. The candle floats were constructed to measure velocities at the water surface and at model scale depths of 15 feet and 30 feet. The correlation of the model flow patterns and the patterns obtained from the Bay studies was thus able to be checked.

When the model was producing the correct tide cycle, it was then necessary to establish the proper environmental temperatures before thermal test data could be obtained. It was desirable to have the air temperature in the model building as near as possible to the model water temperature. This adjustment was accomplished by heating the building air with portable oil heaters or by heating the model water with a 100-horsepower boiler, or both.

After the model water temperature and the building air temperature had become steady and at the desired values, and before the model plant discharge was introduced, model water temperatures were measured to determine ambient or base conditions. All temperature recorders were started and temperatures were measured for two or three model tide cycles. The temperatures recorded on the last ambient tide cycle provided a basis for determining if the model had reached an equilibrium condition with its environment. This temperature data was also used as a base for determining water temperature increase caused by the plant's cooling water discharge.

A total of 42 tests were conducted on the main model between July 1968 and October 1969. Temperature data was recorded directly on magnetic tape by an analog-digital converter. Since as many as 200,000

bits of data were obtained in a single test session; computer processing was used for obtaining results promptly.

The data from the test program was plotted in the form of incremental temperatures, that is, excess temperatures above the Bay ambient, shown as isotherms. These isotherms showed the distribution of excess temperature in horizontal planes at the water surface and at depths of 10 feet and 20 feet for flood tide, high water slack, ebb tide and low water slack. In addition to the horizontal plots, isotherms were also plotted for vertical sections of the Bay at selected positions such as along the outlet centerline and along critical contours.

A copy of the Summary Report prepared by the Alden Research Laboratory is attached to and is made a part of this Environmental Report.

2.2.5 Thermal Effect on Aquatic Life

Using the design criteria suggested by Dr. Ruth Patrick and the results of mathematical studies and the model testing program, a design was developed for the Calvert Cliffs condenser cooling water system that would adequately meet the plant's requirements while at the same time providing for satisfactory protection of the aquatic life within the area of influence of the plant.

Features of the plant's cooling water system design that were selected expressly for the protection of the marine environment are as follows:

1. Condensers were purchased which will have a cooling water design temperature rise of 10 F when the plant is operating at maximum capacity. This low temperature rise will not only limit the maximum temperature to which entrained microscopic organisms will be exposed but will also reduce any thermal shock effect.

2. The intake water will be drawn under a curtain wall extending into the water to a depth of -28 feet. With this curtain wall and a low intake velocity, it is expected that during the summer months most of the cooling water will be taken from below the thermocline where the natural temperatures are below 80 F most of the time.
3. For the same reasons as in Item 2 above, most of the cooling water will also be drawn from below the photosynthetic zone and this should minimize the quantity of plankton passing through the condensers. Also, since there are fewer fouling organisms at the selected intake depth, the need for chlorine treatment of the water should be minimal.
4. The intake under the curtain wall will have a velocity less than one-half foot per second. This low velocity will reduce the possibility of drawing large fish into the plant intake and will also minimize the entrainment of small fish. Any fish that do enter the intake basin may escape by easily swimming back out under the curtain wall against the low intake velocity.
5. The installation of an Amertap system for mechanical cleaning of the condenser tubes is a substitute for the use of chlorine for fouling control of the condenser tubes.

6. The point of discharge of the condenser cooling water will be 850 feet offshore. This location will protect the biologically important shallow water areas and at the same time provide for an ample supply of water for dilution.

7. The momentum jet design of the discharge will result in very rapid mixing with the Bay waters to minimize the change in natural temperatures, oxygen content and salinity.

8. The condenser cooling water will remain at 10 F above its natural temperature for less than four minutes. The threshold for damage to many species at about 90 F is associated with exposure times on the order of 24 hours.

9. The rate of flow of condenser cooling water is larger than normally experienced because of the low temperature rise, but this flow is still less than one percent of the average tidal flow in the plant vicinity and only six percent of the new water available for dilution. No change in the current patterns of the Bay is expected to occur as a result of the use of this quantity of water except in the immediate vicinity of the plant site.

10. The plant will be operated in full compliance with the water quality standards of Maryland.

A great amount of effort has been expended to develop a design for the Calvert Cliffs cooling water system that will be environmentally

neutral. There is reasonable assurance that this has been done. Care and attention will be taken during construction and start-up to assure that there will be no operating errors or accidents that could affect marine life in the Bay. Also, the marine environment will be monitored carefully as load on the plant is increased so that if difficulties do develop they will be recognized immediately and corrected.

2.2.6 Marine Ecology Studies

In order to have a basis for determining any effects on the aquatic life which may be caused by plant operation, the Academy of Natural Sciences of Philadelphia was retained in the fall of 1967 to conduct a comprehensive program of marine studies.

Recognizing minor changes in the marine environment may prove to be very difficult because of the naturally varied nature of life in the Bay. This potential difficulty was identified early and steps were taken in 1967 to formulate a major marine ecology study program at the Calvert Cliffs site.

This program includes the establishment of a baseline of conditions of the aquatic life through survey studies to determine the diversity and relative abundance of protozoa, algae, invertebrates and fish. Special continuing studies are also being conducted on plankton, productivity, commercial fish, crabs, oysters, clams and substrates. Chemical and physical characteristics of the Bay water are being determined through monthly analyses. The investigations are generally being carried out at four stations or areas of the Bay, two within the future area of influence of the plant and two outside this area. Details of the program are included in Appendix C.1, Marine Environment Studies.

This pre-operational program will be continued during the five-

year period, 1968 through 1972, prior to initial operation of the plant. The exact program to be followed each year is somewhat predicated by the findings of the previous year's surveys. The Estuarine Laboratory of the Academy, located at Benedict, Maryland, on the Patuxent River, is the base of operations for most of the work, although some of the program is carried out at the Philadelphia Laboratories.

In the operational phase of the program, the studies will be continued for five years from the date of the first appropriation and use of Chesapeake Bay water, or for a lesser period of time if the Department of Water Resources finds that the results of the studies warrant earlier termination of the research projects. It is presently planned to continue the marine ecology monitoring program beyond this period, but the precise scope of such longer-range studies cannot be identified at this time. The intent of these continuing studies will be to maintain a current knowledge of the condition of the aquatic environment in the vicinity of the plant.

Since the pre-operational baseline studies will cover a period of five years, considerable data will be accumulated on annual cyclic variations in aquatic life conditions which occur naturally. This cyclic information will be useful in identifying and evaluating any changes in aquatic life conditions and in variations of physical and chemical characteristics which may be observed in the study areas during the operational monitoring program.

Laboratory studies will be undertaken in 1971 to obtain information for predicting the effects of time-temperature exposures on entrained organisms. Other studies will define the responses to changes in natural levels of temperature, dissolved oxygen, salinity, radionuclides, heavy metals and chemicals caused by power plant operations. It is expected that effects identified in the laboratory investigations

will be useful in recognizing changes that may occur in the Chesapeake Bay following the start of plant operations.

As a result of the features incorporated in the design of the condenser cooling water system, the Company holds the firm opinion that the marine ecology studies will show that operation of the Calvert Cliffs Nuclear Power Plant will not cause significant changes to the ecology of the marine life in the Chesapeake Bay in the immediate vicinity of the plant and will cause no detrimental changes that will affect the marine life in the remainder of the Bay. In fact, the possibility exists that the thermal additions from Calvert Cliffs could have a net beneficial effect on man's use of and harvest from the Bay.

2.3 Radiological Effects

2.3.1 Sources of Human Exposure

The radiation sources of human exposure must be separated into two categories; namely, (a) natural radiation or background radiation, and (b) man-made or artificial radiation that includes radiation releases from gaseous and/or liquid effluents discharged from nuclear power plants. This latter source of radiation may increase ambient radiation levels with a consequent increase in the doses received by humans. An estimate of such incremental doses must be made to evaluate and control the associated radiation hazards.

2.3.2 Permissible Dose/Concentration

Information concerning the biological effects of radiation on man is primarily derived from animal experiments, from clinical observations, and from statistical surveys. This approach, though not an ideal one, is the only one and is acceptable in our present stage of knowledge. Based on this approach, the International Commission on

Radiological Protection (ICRP) has (a) made many original estimates of doses/radiation intensities received by man and their possible effects, and (b) developed guidelines setting the limits on the Maximum Permissible Concentrations (MPC) in air and water of radionuclides, for protection against radiation. These estimates and guidelines, with some modification, form the basis of the AEC regulations and standards for radiation protection (10 CFR 20).

Two modes of radiation exposure have been considered by the ICRP and the National Council on Radiation Protection (NCRP); namely, gaseous exposure and liquid ingestion. The rate of gaseous exposure and liquid ingestion that will not produce an excess body burden is estimated by considering the biological half-life or turn-over time in man for each radioisotope. These permissible exposure rates (or their equivalents expressed as MPC) form the basis on which the possible hazard to man from radionuclides in the environment can be evaluated and controlled.

2.3.3 Radionuclide Reconcentration

In the case of human-seafood chains capable of concentrating radionuclides at levels above their ambient concentration in water, the concentrations of such radio-elements used for potential dose estimation were obtained by dividing the expected concentration in water by the reconcentration factor; i.e., the ratio of protein intake to water intake. Some literature data on reconcentration factors are available that may not necessarily be applicable to the conditions in the Chesapeake Bay. However, if one makes the reasonable assumption that the discharge of radioactive wastes from the Calvert Cliffs plant will not materially change the chemical composition of the receiving

Bay water, one can use these published values to determine the reconcentration factors for each element in important seafood organisms of the Bay. The data given in Reference (1) were used in the present calculations to estimate the potential human dose received through ingestion of seafood harvested from the Chesapeake Bay.

2.3.4 Expected Radioactive Discharges and the Potential Human Dose

An estimate of the annual expected release of radionuclides in liquid wastes from Unit 1 has been prepared and is presented in Table 2.3.1. Since Unit 2 is similar to Unit 1, the total expected discharge will be twice the values given in Table 2.3.1. The above estimate is based on the following assumptions:

1. One per cent failure of the fuel elements.
2. Fourteen primary loop volumes of waste water are processed per unit.

Neither of these assumptions are realistic, however, since experience with similar reactors, such as the Connecticut Yankee reactor and others, (2) shows that smaller fuel failure rates can be achieved, and smaller volumes of liquid wastes are generated.

Even if the pessimistic figures of Table 2.3.1 are assumed, the discharged radionuclide concentrations are much less than the respective concentrations permitted in drinking water. Furthermore,

$$\sum_{i=1}^{n} \frac{\text{Concentration of the i th Radionuclide}}{\text{Maximum Permissible Concentration of that Nuclide}}$$

is also found to be less than one. In other words, the radioactive wastes to be discharged from the plant are well within the permissible limits.

Table 2.3.1 shows that of the total activity discharged, there will be about 6000 curies of tritium (the only radionuclide released in any significant quantity) per year released by the two units. Since this tritium in the liquid wastes will be in the form of tritiated water, it will be diluted with the Bay water. Using a minimum value of annual fresh water flow through the Susquehanna River and the Upper Chesapeake Bay system of 40,000 cubic feet per second, (1) the resulting tritium concentration in the Bay water would be about 1/6,000 of the MPC for drinking water.

In Table 2.3.2 are listed the estimates of potential radiation dose from liquid releases of the two units. These values were obtained by using the ICRP computational model and the related information given in the NUS report (3). This report was presented in 1969 to the Maryland "Governor's Task Force on Nuclear Power Plants" to evaluate the effects of estimated radioactive effluents from the Calvert Cliffs plant.

Table 2.3.3 includes the expected estimates of gaseous releases per year from both the units. Once again, these values, as well as $\sum_i$ Ci/MPCi, are considerably less than permissible limits listed in 10 CFR 20, where Ci is the concentration of ith radionuclide and MPCi is the permissible concentration.

Using these release estimates, the total potential radiation doses to which an individual and the general population within a 50-mile radius of the plant would be exposed are listed in Table 2.3.4. These values were obtained using a procedure described in detail elsewhere (3)(4).

TABLE 2.3.1

RADIOACTIVITY DISCHARGE

Isotope	Expected Annual Discharge (Curies)	Expected Concentrations in Circulating Water (μC/cc) Short Term Maximum	Yearly Average
H-3	2.91×10^{3}	8.94×10^{-5}	1.53×10^{-6}
Br-84	9.16×10^{-4}	2.80×10^{-11}	4.79×10^{-13}
Kr-85m	5.63×10^{-2}	1.72×10^{-9}	2.95×10^{-11}
Kr-85	2.57×10^{-1}	7.86×10^{-9}	1.34×10^{-10}
Kr-87	3.58×10^{-2}	1.09×10^{-9}	1.87×10^{-11}
Kr-88	1.03×10^{-1}	3.15×10^{-9}	5.39×10^{-11}
Rb-88	1.03×10^{-4}	3.15×10^{-12}	5.39×10^{-14}
Rb-89	2.57×10^{-6}	7.88×10^{-14}	1.35×10^{-15}
Sr-89	1.57×10^{-7}	4.81×10^{-15}	8.22×10^{-17}
Sr-90	6.54×10^{-10}	2.00×10^{-17}	3.42×10^{-19}
Y-90	2.57×10^{-9}	7.88×10^{-17}	1.35×10^{-18}
Sr-91	8.72×10^{-8}	2.67×10^{-15}	4.57×10^{-17}
Y-91	5.23×10^{-6}	1.60×10^{-13}	2.74×10^{-15}
Mo-99	1.24×10^{-4}	3.79×10^{-12}	6.48×10^{-14}
Te-129	7.85×10^{-7}	2.40×10^{-14}	4.11×10^{-16}
I-129	2.57×10^{-6}	7.88×10^{-14}	1.35×10^{-15}
I-131	1.87×10^{-2}	5.73×10^{-10}	9.80×10^{-12}
Te-132	1.66×10^{-5}	5.07×10^{-13}	8.68×10^{-15}
I-132	4.67×10^{-3}	1.43×10^{-10}	2.44×10^{-12}
I-133	2.56×10^{-2}	7.82×10^{-10}	1.34×10^{-11}
Xe-133	7.72	2.36×10^{-7}	4.04×10^{-9}
Te-134	6.98×10^{-7}	2.14×10^{-14}	3.65×10^{-16}
I-134	1.31×10^{-3}	4.01×10^{-11}	6.85×10^{-13}
Cs-134	3.36×10^{-5}	1.03×10^{-12}	1.76×10^{-14}
I-135	1.10×10^{-2}	3.38×10^{-10}	5.78×10^{-12}
Xe-135	2.10×10^{-1}	6.44×10^{-9}	1.10×10^{-10}
Cs-136	3.49×10^{-6}	1.07×10^{-13}	1.83×10^{-15}
Cs-137	7.76×10^{-4}	2.38×10^{-11}	4.06×10^{-13}
Xe-138	1.57×10^{-2}	4.81×10^{-10}	8.22×10^{-12}
Cs-138	2.57×10^{-5}	7.88×10^{-13}	1.35×10^{-14}
Ba-140	2.31×10^{-7}	7.08×10^{-15}	1.21×10^{-16}
La-140	2.31×10^{-7}	7.08×10^{-15}	1.21×10^{-16}
Co-60	4.80×10^{-1}	1.47×10^{-8}	2.51×10^{-10}
Fe-59	3.36×10^{-3}	1.03×10^{-10}	1.76×10^{-12}
Co-58	3.44	1.05×10^{-7}	1.80×10^{-9}
Mn-56	1.00×10^{1}	3.07×10^{-7}	5.25×10^{-9}
Mn-54	8.72×10^{-3}	2.67×10^{-10}	4.57×10^{-12}
Cr-51	1.05	3.20×10^{-8}	5.48×10^{-10}
Zr-95	8.29×10^{-3}	2.54×10^{-10}	4.34×10^{-12}

TABLE 2.3.2

RADIATION DOSES FROM LIQUID RELEASES

	Maximum Dose,* rads	Highest Expected Dose,** rads
Individual Dose		
Annual dose (rads/year) per person eating 120 lbs of seafood per year	9.49×10^{-4}	1.47×10^{-4}
Population Dose		
Total man-rads/year within 50-mile radius	272	41.9
Annual average per capita dose within 50-mile radius***	1.14×10^{-4}	1.76×10^{-5}

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* Maximum dose assumes no dilution in Bay water, no decay and 1% fuel defects in both reactors.

** Highest expected dose; same as "maximum," except for dilution in summer or drought fresh water flow of 35,000 cfs.

*** Based on 1965 population of 2,372,000 to maximize per capita dose. Also based on assumption that all seafood harvested from the Chesapeake Bay was grown inside the Calvert Cliffs plant discharge conduits and the entire catch was eaten by people residing within a 50-mile radius from the plant.

TABLE 2.3.3

MAXIMUM GASEOUS RELEASES

FROM CALVERT CLIFFS NUCLEAR POWER PLANT*

Radionuclide	Activity (Curies), with 60-Day Decay	
	Per Primary System Volume	From Both Units Per Year (Ci)**
Kr-85m	---	---
Kr-85	1600	44,800
Kr-87	---	---
Kr-88	---	---
Xe-131m	19	532
Xe-133	17	476
Xe-135	---	---
Xe-138	---	---
	Total	45,808 Ci

* From Table Presented at Hearings of May 13, 1969, (Docket Nos. 50-317, 50-318), following Transcript Page 292.

** Assuming 28 primary system volumes/both units/year.

TABLE 2.3.4

RADIATION DOSES FROM GASEOUS RELEASES

Individual Dose	Maximum--Two Units, each with 1% Fuel Defects	Actual Expected Releases High***	Actual Expected Releases Low***
(a) Dose rate*(rads/year) at site boundary	0.0125	0.00019	0.000005
(b) Average annual dose (rads/year) per person (within 50-mile radius)	0.00004	0.00000062	0.000000016
(c) Natural background radiation dose (rads/year)	~ 0.125	~ 0.125	~ 0.125
Population Dose **			
(d) Total man-rads/year (within 50-mile radius)	181.293	2.81	0.073
(e) Total man-rads/year from natural background radiation	593,750	593,750	593,750

*Assuming a hypothetical individual spends 24 hours a day, every day, on the closest site boundary.

**Based on 2010 population of 4,750,000 within 50 miles of the Calvert Cliffs Plant.

***Based on actual releases from a number of operating pressurized water reactor power plants.

2.3.5 The Biological Effects of Radiation

The radiation effects of interest associated with the normal operation of a nuclear reactor are the delayed responses to very low-level, long-term radiation exposure. These effects are generally classified in two separate categories; namely, (1) somatic effects (i.e., damage occurring in the irradiated individual) and (2) genetic effects (i.e., damage passed on to the future generations.)

2.3.5.1 Genetic Effects

In the human species, genetic effects are very difficult to evaluate for no direct experiments can be undertaken. The frequency of spontaneous mutations and the exact number of genes in human beings are unknown. Social conditions probably interfere with biological phenomenon; medical care maintains alive individuals with genetic defects who may reproduce themselves (although generally at a reduced rate) and transmit deleterious genes which otherwise might have been eliminated.

An approach has been made, however, for estimating the genetic detriment to man. This is based on the concept of "genetic death," which is defined as the extinction of a gene lineage through the premature death or reduced fertility of some individual carrying the gene, and is quite different from the actual death of an individual due to radiation.

The ICRP (5) estimates that a parental generation of one million people exposed to one rad may suffer about 2000 "genetic deaths" (i.e., 0.1% of the natural incidence) during the next ten generations. This number increases to 8500 (i.e., 3.6% of natural rate) if projected to equilibrium conditions that can only be attained after infinite time.

In relation to genetic risks, the ICRP (5) stated in summary:

"In the present state of knowledge any evaluation of genetic risks from radiation is beset with uncertainty, largely because it is necessary to rely on much indirect evidence obtained from experiments with animals. In view of this, and because of the importance of avoiding the inadvertent under-estimation of risks, many assumptions, which may in due course prove to be unduly pessimistic, have been made."

The above estimates of genetic risks from radiation, therefore, may be probably higher than the actual numbers yet unknown.

2.3.5.2 <u>Somatic Effects</u>

The somatic effects of general interest are the induction of various types of cancer, including leukemia; thyroid and bone cancer; the production of prenatal abnormalities; and non-specific, life-span shortening. Statistical studies of various groups of population exposed to radiation, in the U.S. and elsewhere, have not revealed any clear evidence of overall life-shortening. However, there are indications of increased incidence of leukemia to be the major consequence when a substantial part of the body is exposed to extremely small doses fractionated over a long period of time.

The ICRP (5) has estimated that the total risk for leukemia is about 20 cases per million persons exposed to one unit of absorbed dose (1 rad) and that the risk from all other types of cancer is about 100-120 cases per million per rad. (7) Thus for exposure of a substantial part of the body, the total risk for cancer may be estimated at about 140 cases per million persons per unit of absorbed dose. These numbers refer to the annual risk under continuous exposure to one rad per year or to the lifetime risk from a single exposure to one rad. It is important to

realize that the above calculations have been based on the most pessimistic assumptions; namely, that for cancer-induction, there is no threshold; the response is linear; every dose, however small, counts; there is no recovery in spite of the repair mechanism known to be operative in biological systems.

If one includes in the above calculations an optimistic but acceptable hypothesis, which assumes a "threshold," considered as probable by many researchers in the field, and sets the threshold value at about 400 rem, (6) then the cancer hazard falls to near zero even if the weapons tests continued for another 100 years at the rate of testing of the years 1955-1960. Consequently, it is reasonable to say that any present attempt to evaluate the effects of radiation to which the world population or a selected group of population is exposed, can produce only tentative estimates with wide margins of uncertainty.

2.3.5.3 Biological Effects of Calvert Cliffs Operation

To provide some perspective on the effects to be expected as a result of the incremental exposures from Calvert Cliffs waste discharges, the doses listed in Table 2.3.5 under "Maximum Dose" were used to provide risk estimates. The results are presented in Table 2.3.6.

If it is assumed that a generation is approximately 30 years, the operation of this plant for 30 years would result in an individual probability of "genetic effect" in the subsequent first generation of about three chances per 100 million per year. If the operation proceeds for 10 generations, the individual probability of a genetic consequence would be about 30 chances per 100 million per year, and for infinite time of operation the probability is increased to 130 chances per 100 million.

As regards the somatic effects, the individual annual probability would be about two in 100 million persons per year. (Ref. (3) updated by

TABLE 2.3.5

TOTAL RADIATION DOSE FROM GASEOUS AND LIQUID RELEASES

Individual Dose	Maximum Dose	Highest Expected Dose
Dose rate (rads/year) at site boundary	0.0135	0.000337
Average dose rate (rads/year) per person eating 120 lbs of seafood per year	0.000989	0.000148
Natural background radiation dose (rads/year)	~ 0.125	~ 0.125
Population Dose		
Total man-rads/year within 50-mile radius	453	44.7
Total man-rads/year from natural background	300,000-594,000*	300,000-594,000*
Annual average per capita dose within 50-mile radius (rads/year)	0.000154	0.0000182

*Based on 1965-2010 population values

TABLE 2.3.6

BIOLOGICAL EFFECTS OF CALVERT CLIFFS OPERATION

	Expected Number of Cases*	
	Without Plant	With Plant
Leukemia	166/year	166.009/year
Other Fatal Neoplasms	3,560/year	3,560.03/year
"Genetic Deaths" over next 10 generations	5,700,000	5,700,021

*Based on 1965 population within a 50-mile radius of the plant.

Ref. (7).) This risk is exceedingly small compared to the normal death rate of about 10 per thousand.

From the foregoing considerations, it is clear that the estimates of risks that may be associated with plant operation are insignificant. In view of this and the degree of conservatism involved by way of pessimistic assumptions in providing these final estimates, one may reasonably conclude that the Calvert Cliffs plant will not constitute a threat in any significant way to the health and safety of the present or future residents of the area.

REFERENCES FOR SECTION 2.3

(1) "Nuclear Power Plants in Maryland" - Governor's Task Force on Nuclear Power Plants, December 1969.

(2) William H. Oates, Jr. "Radiation Exposure Overview, Nuclear Power Reactors and the Population." U.S. Department of Health, Education and Welfare, January, 1970.

(3) (NUS-TM-87) "Effects of Estimated Radioactive Effluents from the Calvert Cliffs Nuclear Power Plant," by M. I. Goldman *et al*.

(4) Preliminary Safety Analysis Report for Calvert Cliffs Nuclear Power Plant, Baltimore Gas and Electric Company, January, 1968.

(5) ICRP Publication 8: Report of Committee 1 on the Evaluation of Risks from Radiation, Pergamon Press, New York, 1966.

(6) BACQ.Z.M. Fundamentals of Radiobiology, p. 504, 2nd Edition, Pergamon Press, 1961.

(7) ICRP Publication 14: Radioactivity and Spatial Distribution of Dose, Pergamon Press, New York, 1969.

2.4 Chemical Releases

The intake structure will be equipped with a chlorination system to provide a means for injecting chlorine into the cooling water entering the plant to control slime and algae growth within the intake structure and in the cooling water piping between the intake structure and the condenser. An Amertap system will be installed for mechanical cleaning of the condenser tubes. If chlorination is required, continuous measurements of the residual chlorine content of the cooling water will be recorded at the inlet to the condensers and periodic measurements will be made of the cooling water discharged to the Bay. Although the equipment associated with this system will be installed, the plant will be started without the use of chlorine, and chlorine will not be used unless found necessary for continued operation of the plant. It is expected that the use of the deep intake will materially reduce the fouling problem since water in the lower strata of the Bay contains fewer fouling organisms.

If it is found necessary to use chlorine or other biocides, approval will be required from the Department of Water Resources, and use of the chlorine or other biocides will conform fully with all conditions which may be imposed by the Department.

The chemical and radiochemical waste recovery systems are described in Appendix B. Small quantities of some materials such as chromates, borates, acids, alkalis, cleaning compounds, etc., will escape recovery and be released in the discharge conduits in concentrations well within the drinking water criteria of the Federal Water

Quality Administration, (1) and well within the limits set by the State of Maryland, Department of Water Resources.

In addition, the potential consequences of these low concentration releases will be studied prior to plant operation and careful surveillance continued after plant operation (Appendices A and C). The results of these studies will be submitted to the Maryland Department of Water Resources in accordance with the Calvert Cliffs water permit.

2.5 Physical Presence

2.5.1 Area and Activities

The site of the Calvert Cliffs Nuclear Power Plant consists of approximately 1135 acres of forests and farmlands and is located on the western shore of the Chesapeake Bay, 11 miles south of Prince Frederick in Calvert County, Maryland.

The site is located in an undeveloped and sparsely populated area. The present population within 30 miles of the site is small. However, moderate increases, on the order of 1.5 percent per year, are estimated over the next 45 years. Present and future population characteristics of the area are discussed in Section A.2.0.

At the present time, the major portion of the land surrounding the site is devoted to agricultural and forest uses. Although the amount of land devoted to farming is declining, agriculture should continue to be a primary land use. Small increases in the amount of land devoted to residential and commercial uses will occur with increased population growth. Land use characteristics of the area are discussed in Section A.3.0.

(1) "Report of the Committee on Water Quality Criteria," FWPCA, April 1, 1968, p. 20.

The waters of the Chesapeake Bay are now and should remain a source of seafood.

The relatively small staffing of a nuclear plant will preclude significant changes in population and character of the area. The economic benefit to the area is significant since the presence of the plant will more than double the assessable basis of all real and personal property in Calvert County.

2.5.2 Site and Plant Features

The original site consisted of approximately 985 acres of forests and farmlands, as shown on Figure 2.5-1. The original site was bordered on the southeast by Camp Conoy, which consisted of approximately 150 acres and was owned by the Baltimore YMCA. Camp Conoy was a summer camp and was in need of repairs and renovations. The Camp Conoy property was purchased by the Company, and the Baltimore YMCA plans to use this purchase money to provide better facilities at another camp. With the addition of Camp Conoy property, the site presently comprises approximately 1135 acres.

The plant will occupy 75 to 100 acres of the site. The structures employ a clean, functional, low profile design that will blend as harmoniously as possible with their surroundings. A photograph of the plant model is shown in Figure 2.5-2. The plant structures are not visible from the adjacent highway, and a concentrated effort has been made to preserve as many trees as possible along the shoreline to provide maximum visual screening from the water. In addition, a nuclear plant is free of the sounds and appearance of bulk fuel handling facilities associated with a fossil-fueled generating plant. The progress of plant construction as of October 6, 1970, is shown in Figure 2.5-3.

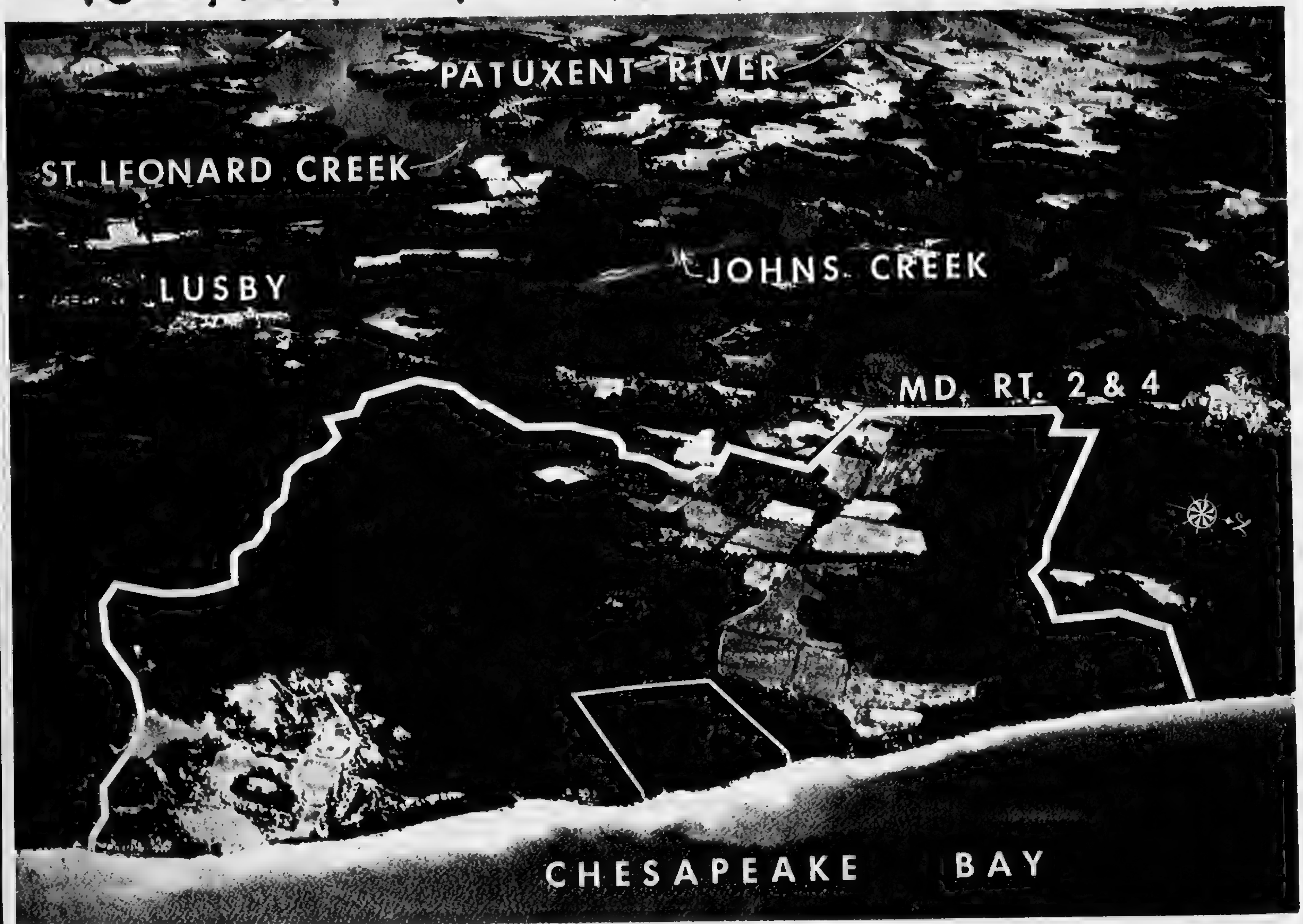

PATUXENT RIVER
ST. LEONARD CREEK
LUSBY
JOHNS CREEK
MD. RT. 2 & 4
CHESAPEAKE BAY

FIGURE 25-1

ARCHITECTURAL MODEL

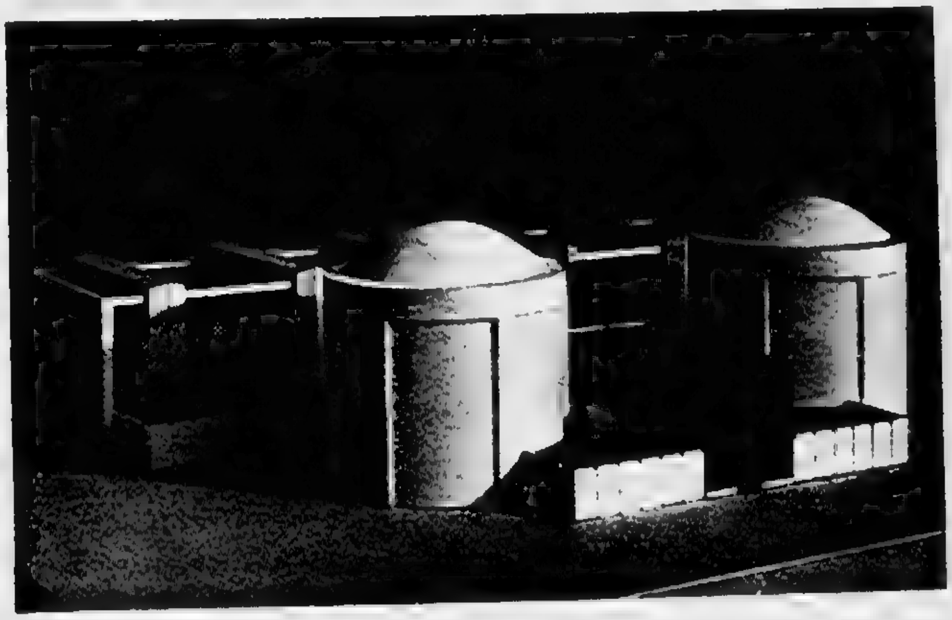


FIGURE 2.5-2

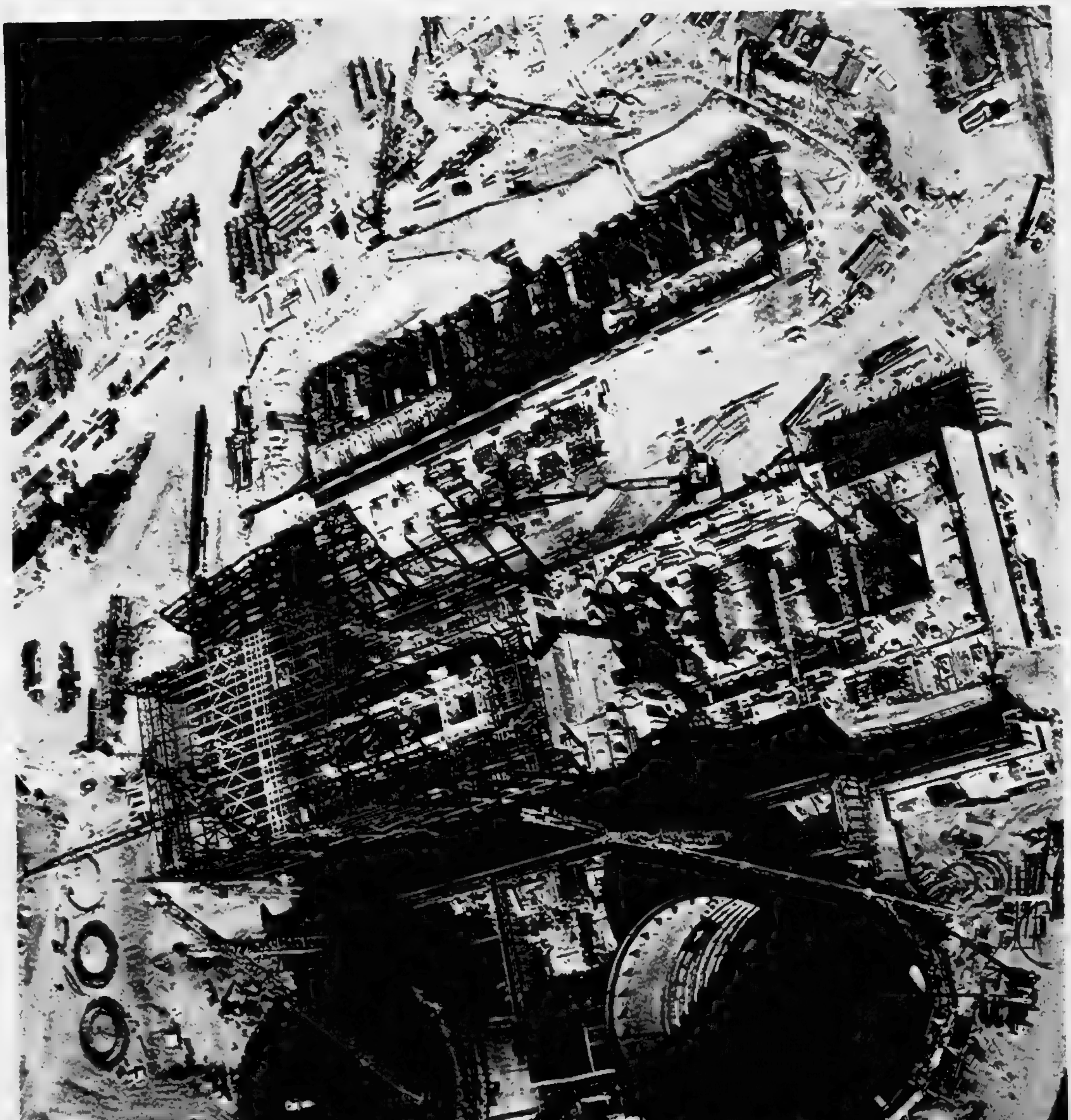


FIGURE 2.5-3

An oyster bar existed in the Bay waters in front of the plant. The Company recognized the adverse effects of the proposed dredging for the barge channel, intake cooling water channel, and discharge cooling water conduit in the area of the oyster bar, and as a result, reimbursed the State of Maryland for the loss of the oyster bar and relocated the oysters to other more productive bars.

The proposed dredging for the intake and discharge cooling water facilities will result in approximately 3,000,000 cubic yards of spoil material. There is no public disposal area in the State for the disposal of this material. Therefore, a deep ravine of approximately 100 acres on site will be used for the disposal of the dredged spoil material. It is contemplated that this area will ultimately be converted to farmland or forests.

A portion of the shoreline is part of the famous Calvert Cliffs, which are noted for their scenic and scientific significance. An area of the Cliffs was made available to the Maryland Academy of Sciences for exploration and studies related to paleontology.

An overlook viewing structure was built, an existing tobacco barn was remodeled, and appropriate exhibits were installed describing the Calvert Cliffs plant and the fossil studies of the Maryland Academy of Sciences. These facilities serve as a visitor's center.

Most of the property will be preserved in its natural condition of forests and farmlands. No recreational facilities are contemplated since Calvert Cliffs State Park is approximately 2.5 miles south of the site.

There are two ramshackle unoccupied houses in a state of total disrepair on the Calvert Cliffs property which are registered as historic sites by the Maryland Historical Trust, but are not listed

in The National Register of Historic Places 1969. Further investigation by the Company discloses no other historic sites near the plant site.

2.6 Other Impacts

2.6.1 Intake Screens

With any water intake scheme, the potential always exists that fish might be trapped on the traveling screens in the intake structure. Recognizing that a potential problem may exist, the Company is sponsoring additional research through Dr. Edward C. Raney of Ichthyological Associates and Mr. Dan Bates of Portland, Oregon, Bureau of Commercial Fisheries, Fish and Wildlife Service, United States Department of the Interior. This research effort is directed toward the development of equipment to safely remove large numbers of fish from directly in front of traveling or stationary screens.

If large numbers of juvenile fish do congregate in the intake basin, the probability is greater that this will occur during the colder months of the year rather than during the summer months. Therefore, consideration is being given to the possibility of removing sections of the curtain wall during the winter to provide a greater degree of freedom for egress of fish from the intake basin. Hydraulic model studies and structural design studies are currently in progress to determine the feasibility of such a curtain wall design. If such flexibility is constructed into the curtain wall, it would have to be kept closed during the summer so the wall could provide its intended protection of the environment.

2.6.2 Transmission Facilities

Transmission facilities linking the Calvert Cliffs plant to the electric power networks in the southern and central Maryland area have been certified by the Maryland Public Service Commission.

Under a recent Maryland law no electric company may begin the construction of any high voltage overhead transmission line without having first obtained from the Commission a certificate of public convenience and necessity for the construction of the line.

The Commission held public hearings in connection with these certificates. Lines were routed and rerouted in some cases to minimize the impact on scenic beauty, historic sites, existing buildings, and aesthetic considerations. In many cases, the lines were routed around hills rather than over them. As much foliage as possible is being retained or restored to screen the structures from public view, and selective clearing is being employed on the right-of-way. No biocides or herbicides will be used to control vegetation growth.

Furthermore, aesthetically pleasing tower designs will be utilized where appropriate.

Maryland became the first State to adopt the guidelines for transmission facilities recommended by a special committee in a 1968 report to the Vice President's and the President's Council on Recreation and Natural Beauty, and the Maryland Public Service Commission incorporated these guidelines as a part of the certification. Also being applied to the construction of the Calvert Cliffs transmission facilities are the "Standards and Specifications for Soil Erosion and Sediment Control in Urbanizing Areas" which were developed by the

Maryland Department of Natural Resources and the Soil Conservation Service of the Department of Agriculture.

It is the belief of the Baltimore Gas and Electric Company that it is applying to the design and construction of the transmission facilities for Calvert Cliffs the latest and most appropriate guidelines to minimize the impact of these facilities on the environment.

2.6.3 Use of Ground Water

The Company will require fresh water for sanitary facilities for plant personnel, plant make-up water and fire protection. On July 21, 1969, the State of Maryland - Department of Water Resources issued Permit No. CA69GA010 for the appropriation of an average of 600,000 gallons of water per day and not to exceed a maximum of 865,000 gallons in any one day during each of the twelve months of the year, from wells located on the Calvert Cliffs site.

3.0 POSSIBLE ADVERSE EFFECTS

"Adverse" has been defined as acting contrary to one's interest or contrary to the desired effect. The "interests" involved should be primarily those of the people of the region, with special emphasis on those in the immediate locale. A number of well-advertised and well-attended public hearings have been held in which interested persons and groups have exercised the opportunity to speak and lay claim upon effects of the Calvert Cliffs Plant which allegedly run contrary to their interests. In each proceeding the Company has set forth the evidence it has developed and calculations it has made regarding the potential risks or costs involved. In the same spirit, the Company has examined over and over the claims made by articulate adversaries in order to leave no stone unturned.

Similarly, in this report, the Company has searched hard for possible significant or lasting "adverse" effects upon man and/or his environment. It has discussed in detail the surveillance programs designed to detect adverse effects. It has discussed the methods by which all state, local, and federal regulations for protection of the health, safety and welfare of the people and of the environment will be followed. The Company sincerely expects no adverse effects. Should there arise any unexpected adverse effects, the Company intends to respond without delay. The Company has a long and creditable record of promptly investigating all complaints and of rectifying or compensating bona fide and legitimate complaints.

4.0 ALTERNATES TO THE PROPOSED ACTION

There is an urgent need for the additional installed generating capacity as proposed at Calvert Cliffs with completion required of Unit No. 1 in early 1973, and Unit No. 2 in early 1974, to enable the Company to continue supplying the total electric load within its franchised territory. It is estimated that without the proposed additional capacity, the Company's generating capacity reserve will be essentially zero in 1973, and the peak loads will exceed the available capacity because of the probability that some capacity will be forced out of service for repairs and necessary maintenance. This situation will be progressively worse in 1974 and 1975 and thereafter as the load grows each year. Increased demands for electricity caused by unusually hot weather during any or all of these years would result in additional deficiencies in generating capacity. Furthermore, the Potomac Electric Power Company, which distributes over 50 percent of its total generation to customers in Maryland, plans short-term purchase of portions of the proposed new capacity and such purchases would constitute nearly all of their reserve generating capacity in the years 1973 and 1974.

Alternatives to the completion of Calvert Cliffs, which are described below, take into consideration today's possibilities rather than opportunities existing during the planning period of four years ago. The plant is approximately 25 percent complete. To suspend construction at this time and attempt to provide a comparable substitute could create a financial crisis for the Company, the customer, and possibly even the State of Maryland. In each of the categories below, as it is applicable, a qualitative assessment has been made of the effect of the alternatives on the customer, the Company, the PJM Interconnection and the State of Maryland.

4.1 Not Providing the Power

Not providing the power at all would result in extensive brown out periods in Baltimore throughout much of the year. The base-load type generation of Calvert Cliffs is expected to operate at a high capacity factor and supply about 1/3 to 1/2 of the total energy and capacity requirements of Baltimore during the mid-seventies. Without Calvert Cliffs all of the existing generating equipment would be forced to operate longer hours at highest output with less maintenance, thereby compounding the effect of the deficiency and further diminishing system reliability.

Baltimore could not fulfill its contractual commitments as a participant in the Pennsylvania, New Jersey, Maryland Interconnection (PJM) without this plant. The lack of Calvert Cliffs as part of the PJM capacity would reduce the Interconnection reliability index to less than the standard for 1973 and 1974. The resultant deficiencies would place and undue burden on interstate commerce since the output of this plant would be shared with companies in Pennsylvania, New Jersey, Delaware and the District of Columbia.

The economic impact on all parties is the most severe of any of the alternatives. The consequences of higher power cost and less reliable service would discourage industry which would mean fewer jobs, and a smaller taxable base for the State.

4.2 Importing Power Instead of Generating It in Central Maryland

Importing power instead of generating it in central Maryland implies that the generating capacity must be available somewhere else. PJM will not have an adequate surplus on which Baltimore could rely although there will be occasions, during light load periods but unfortunately

not during the critical peaks, when Baltimore could purchase excess capacity from the Interconnection. If power must be imported, it would be necessary for Baltimore to finance, lease or build additional generating capacity at sites which would have to be acquired.

Bulk power import transmission facilities would require reinforcement or addition to carry the new extra-territorial capacity into the Baltimore area. It is expected that there would be considerable reinforcement and addition to the underlying, internal transmission in order to balance load flow in the system.

From a practical standpoint, there is insufficient time to plan and construct a new generation and associated transmission system to replace the loss of Calvert Cliffs. The costs to the Company and the customer would increase for purchased power, new facilities, and the write-off of Calvert Cliffs. The economic reaction in the State should be similar to what is described in Section 4.1 above.

4.3 Building a Fossil-Fuel-Fired Plant in Lieu of a Nuclear Plant

Building a fossil-fuel-fired plant in lieu of a nuclear plant would necessitate redesign of the system as in Section 4.2 above. Aside from obtaining the necessary certification and permission to build and operate on existing sites, present construction schedule estimates show that this type capacity could not be in service before 1975 - two years after required. Operating costs for fossil fueled plants - even if the required low-sulfur fuel were available - are estimated to be considerably higher than Calvert Cliffs. Reliability and availability of power should be about the same as with Calvert Cliffs after 1975 with this alternate fossil fuel plant in service. However, in 1973 and 1974 there would exist a condition similar to that described in Sections 4.1 or 4.2 above.

4.4 Using Gas Turbines in Lieu of a Steam Electric Plant

Using gas turbines in lieu of a steam electric plant would circumvent the timing problem by allowing earlier installations. However, this alternative would be totally impractical for several reasons. This type of generation could supply capacity but not the base-load energy requirements for the system. It is unlikely that there would be enough satisfactory sites to accommodate all the gas turbines required to replace Calvert Cliffs capacity. Natural gas would not be available and the supply of oil is tenuous. The resultant cost of installation, operation, power interchange and write-off of the Calvert Cliffs project would make the use of gas turbines very expensive.

4.5 Possible Cooling Alternatives

The variety of cooling system alternatives available to designers of power plants is very often severely restricted by the specific location of the site itself. In the case of the Calvert Cliffs site, the only practicable method of cooling is the once-through system that is being installed. No other alternative method utilizing currently available technology, regardless of cost, would result in as minimal an impact upon aesthetic and environmental considerations. The reasoning behind this conclusion is discussed in the following sections:

4.5.1 Plant Cooling Requirements

A steam-electric power plant, whether nuclear or fossil fueled, is basically a four-step energy-conversion process. The first step (1) converts nuclear or chemical energy into heat, (2) this heat is transferred to steam, (3) the steam is then used to produce mechanical or rotational energy in a steam turbine, and finally (4) this mechanical

energy spins a generator where energy in the form of electricity is produced. The laws of nature prohibit the conversion of all of the energy in the fuel into electricity. That amount of heat that cannot be used must ultimately be discharged into the atmosphere.

Most of the waste heat that must be removed from a power plant is contained in the spent steam exhausting from the steam turbine. This steam is condensed back into water in a condenser as heat is removed by cooling water flowing through tubes that are located in the path of the steam. The heated cooling water must convey this same quantity of heat to the atmosphere through the techniques of conduction, convection, radiation or evaporation and in a manner that will have a minimum impact on the environment. In theory, there are a number of different ways that this may be accomplished.

4.5.2 Cooling Ponds

Artificial cooling ponds or lakes have been used to transfer heat from power plants to the atmosphere. About 1.5 to 2 acres of surface water are required for each megawatt of power generated. Since the Calvert Cliffs plant will have a capacity of 1750 megawatts, a cooling pond of from 2625 to 3500 acres would be required.

The plant site contains only 1135 acres and obviously is not large enough for such a cooling pond and its topography is completely unfavorable. Therefore, if a pond were to be used for the Calvert Cliffs plant, it would have to be constructed in the waters of the Chesapeake Bay itself, using a system of dikes. If it is considered that such a pond would be located adjacent to the plant site property only, it would extend two to three miles out into the Bay. The construction of dikes this far out into the Bay would be a monumental task and would have disastrous effects on every other conceivable use

of the Bay, either by the marine life in the Bay or by man. Therefore, it is considered that the cooling pond concept for cooling the power plant at Calvert Cliffs is totally unacceptable for reasons of cost, feasibility and adverse environmental impact.

4.5.3 Fresh Water Evaporative Cooling Towers

From both technical and economic considerations, fresh water cooling towers are an acceptable method of transferring waste heat to the atmosphere if an adequate supply of fresh water is available for make-up to replace the water that is evaporated and blown down. However, in the case of the Calvert Cliffs site, there are no lakes or rivers in the vicinity that would provide for such a supply of fresh water. Therefore, fresh water cooling towers could be used at this site only if there was an adequate supply of ground water that could be used for make-up.

The Maryland Department of Geology, Mines and Water Resources has estimated that the total ground water supply for Area 4 (comprising southern Anne Arundel, southern Prince George's, eastern Charles and all of Calvert and St. Mary's counties) is 25 to 50 million gallons per day. Cooling towers for the Calvert Cliffs plant would require 20-25 million gallons of water a day for make-up, and this is obviously unacceptable for it would consume an unreasonable amount of the fresh water available to the area.

4.5.4 Salt Water Evaporative Cooling Towers

Since fresh water cannot be used for evaporative cooling towers at Calvert Cliffs, consideration has been given to the possibility of using salt water from the Chesapeake Bay. Experience with salt water cooling towers has been limited, but there are a few small towers in

various parts of the world operating with salt or brackish water, most of which are the mechanical draft type.

One installation with two natural draft towers at a 90 Mw power plant in Fleetwood, England, has been in operation since 1955, and it is reported that the operation has been satisfactory and that there have been no noticeable environmental effects. The experience with these two relatively small towers, only 250 feet high and 216 feet in diameter at their base, is encouraging.

Nevertheless, these towers and the other units currently in service are extremely small when compared with the towers that would be required for a plant the size of Calvert Cliffs. It is believed that substantial research and development will be required to develop the necessary design information before an acceptable salt water cooling tower system could be specified for a large multiple unit power plant.

The potential off-site effects from large salt water towers at Calvert Cliffs was considered in some detail by a special task force in a report to the Governor of the State of Maryland titled "Nuclear Power Plants in Maryland," dated December, 1969. The appropriate section is quoted below:

> "Water drawn from the Chesapeake Bay might be considered for use in cooling towers. With modern design, the spray carryover can be reduced to 0.2 percent of the cooling water flow. For a tower system, the circulating water flow could probably be approximately 3000 cubic feet per second and the spray carryover might be 6 cubic feet per second. Bay waters off Calvert Cliffs have salinities ranging seasonally from 12,000 to 17,000 ppm. At a salinity of 15,000 ppm, the spray carryover

could amount to 210 tons of salt per day. There are no observational data on such systems since large towers have not been used with salt water. Observations with smaller towers have shown significant local fallout of salt. It is interesting to note that if one half of the emitted salt is deposited locally, ground water supplies might be contaminated. With an average rainfall of 5 inches per month, the soil and ground water might have the following concentrations as a function of fallout area:

Area	Ground Water Salinity
1 square mile	8,400 ppm
10 square miles	840 ppm
100 square miles	84 ppm

Along the same line of speculation, the remaining air-borne salt might be mixed into the air flowing across Calvert County. If it were dispersed in a band of air 40 miles wide and 1650 feet high (the mixed layer of the atmosphere on a typical day - less mixing would occur with inversions) which was flowing at the mean summer wind speed of 6 knots, the average concentration of air-borne salt would be 12 micrograms per cubic meter. Some feeling for what this salt concentration represents may be obtained from the observations of Woodcock (1953 J. Meteorol., 10, 362-371) that such concentrations of salt were observed over the ocean when a Force 7 wind (32-38 mph, moderate gale) was blowing. The changes in the local ground water and atmosphere caused by using Bay water in cooling towers appear to be unacceptable."

In the preceding paragraphs from the Governor's Task Force Report, it was mentioned that "the spray carryover can be reduced to

0.2 percent of the cooling water flow." However, from more recent information it appears as if spray carryover, or drift, might be as low as 0.03 percent, or even 0.015 percent of the cooling water flow in properly designed and operated natural draft towers. With these reduced amounts of spray carryover, and with the additional consideration that the salinity of the water in the cooling tower would be more like 45,000 ppm, the quantity of salt deposited on the ground from tower operation would amount to between 45 to 90 tons of salt per day. Until more is known about the effects of such salt deposits on vegetation, it is recommended that the construction of salt water towers of the size contemplated here be deferred until their desirability and suitability are more clearly defined.

4.5.5 Dry Cooling Towers

Dry cooling towers are mentioned as an alternate cooling method in a theoretical sense only. They are the least efficient and most costly type of cooling device available and neither the actual need nor the state of development have advanced to the point where serious consideration is being given for the actual installation of such type towers on large power plants at the present time. Nevertheless, because this type of dry or non-evaporative cooling tower does not require a consumptive use of water, there is little question that it will find use in special applications in the future.

4.5.6 Once-Through Cooling

It is generally considered that for power plant sites where there is an adequate supply of surface water and when such use in once-through cooling systems does not violate applicable water quality standards, this method of cooling has the advantage of low cost, minimum consumptive water use, and minimum intrusion on the natural environment and upon aesthetic considerations.

On the basis of considerations previously discussed regarding the other alternate cooling systems, and comparing the relative advantages, disadvantages and practicability, it is concluded that the only practical method of cooling available at the Calvert Cliffs site is the once-through system. While this method of cooling has been selected, it must be recognized that there is an infinite number of combinations of various design details that could be utilized in such a system. It is considered appropriate to draw attention to certain of the more significant design details that were selected to minimize the potential environmental impact of the plant.

1. <u>Temperature Rise Through Condenser</u>

When preliminary design details were first established in 1967 for the Calvert Cliffs plant, a design temperature rise of 12 F was selected for the cooling water passing through the condensers. This was in substantial agreement with the last three coal-fired units installed by the Company between 1960-66. This temperature rise was reduced to 10 F as a further measure of conservatism, even though the change increased plant cost by about $2,500,000.

Following this initial design decision, a number of others followed, each being made for the express purpose of minimizing the plant's impact upon the environment.

2. <u>Curtain Wall Concept at Intake</u>

On the basis of the results of tests on the Alden Research Laboratory Chesapeake Bay model and recommendations by Dr. Patrick, a design was developed for the intake which utilized a curtain wall concept. This curtain wall will be located in front of the traveling screens and will be extended down into the water to an elevation of -28 feet and the intake opening below has been sized to maintain an

intake velocity of less than one-half foot per second. This design concept also requires dredging an intake channel a minimum of 40 feet deep extending about 4500 feet into the Bay. The ecological reasons for this design are discussed in Section 2.2.3. The alternative configuration originally considered without the curtain wall would have cost about $4,000,000 less, but would have had the disadvantage of a shallow water intake which would have attracted warmer water with greater quantities of plankton and other entrained organisms, and possibly would have had excessive recirculation of cooling water from the discharge back into the intake.

3. High-Velocity Offshore Discharge

Model studies were made with numerous discharge configurations, including high-velocity and low-velocity discharge schemes at the shoreline and high-velocity discharge schemes offshore through pipes or conduits of varying lengths. The point of discharge was varied from about 400 feet to 2000 feet offshore. The final model tests indicated that the discharge should be a submerged high-velocity jet about 850 feet from the shore. At this point, adequate mixing will be obtained to reduce effluent temperatures as rapidly as possible, recirculation will be essentially eliminated and the shallow water areas will be avoided. This offshore discharge scheme will cost about $3,000,000 more than a comparable design with the discharge at the shoreline.

4.6 Site Alternatives

Commitment to purchase the Calvert Cliffs site was made in the summer of 1966, and it was publicized widely in the press that the site would probably be used for a nuclear power plant. At about the same time, a 670 acre site on the Bush River north of Baltimore and

375 acres adjacent to the Herbert A. Wagner Power Plant site in Baltimore Harbor were also acquired.

The NUS Corporation was commissioned to examine these three sites and to report on their suitability for subsequent utilization as sites for nuclear power plant installations. In a proprietary report issued on September 30, 1966, the following conclusion was reached:

> "Of the three sites studied, the Calvert Cliffs site appears to be the most suitable for the location of a nuclear power plant on the basis of safety. This conclusion is based on the relatively low population density in the environs of the Calvert Cliffs site and the resulting lower capital expenditures required for containment at Calvert Cliffs as opposed to the other two sites. There are design and operating aspects which would need further investigation (effect of the topography on atmospheric dilution and the thermal effects on the offshore waters), but none of these appears to present a major or insurmountable problem."

The choice of the Calvert Cliffs site over the other two available sites was based largely on environmental considerations. The decision to install a nuclear power plant on this site was publicly announced on May 29, 1967. During the past three-and-one-half years considerable data and information has been developed to document the environmental acceptability of the site for a power plant. All available information justifies the conclusion that there are no other sites available at this time in the Baltimore area that are as environmentally suitable as the Calvert Cliffs site for a nuclear power plant.

5.0 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

The record of the long-term productivity of the site locale is clearly written in the fossils to be seen everywhere on the site, and in the history of the surrounding Chesapeake Bay country.

There is little doubt that the productivity of the Chesapeake Bay as a whole with respect to fish, oysters, crabs and perhaps other aquatic species has suffered an overall net loss due to modern man's encroachment and his failure to take adequate conservation measures. "Conservation measures" has come to mean not only maintenance but also enhancement of our environment, increasing the productivity of desirable life forms.

With a clear mandate from the people of the area, the States of Maryland and Virginia, through their natural resources-oriented agencies, and with the cooperation of like-minded local agencies and institutions, have begun to move forward to reverse the trend of the last century, and to provide the conservation and resource development measures needed for future generations.

The Baltimore Gas and Electric Company and its thousands of employees share in no small way the custody of the "Land of Pleasant Living," and wish to remain in the fore of the drive for a better quality of life.

The first and foremost need is the provision of abundant, low-cost electric power -- nuclear power, because it is, by far, the kindest to the environment of all the processes available to date. This is not to imply that the increasing and wise utilization of coal and other fossil fuels is not both desirable and necessary. Future progress demands prudent use of our energy resources.

The Calvert Cliffs Plant would not only be the first nuclear plant in Maryland, it would be the first nuclear power plant in the country with condensers designed for a temperature rise of only 10 F. It would be the first installation on the Chesapeake Bay to be preceded by comprehensive studies to minimize its environmental impacts. Already under way is perhaps the most extensive pre-operational marine ecology study of an area of potential power plant impact. It will incorporate many studies never before carried out on any part of the Chesapeake Bay.

The marine ecology studies will include the most comprehensive operational surveillance network yet conducted in the State. Besides the routine surveillance, the studies of the growth rates, uptake and flushing of various substances in the discharge and control areas, using edible, commercial species are expected to be of long-term significance to the development of aquaculture programs. Similarly, the study of the effect of the artificial upwelling of the bottom waters created by the plant is expected to provide valuable scientific information.

The release of small concentrations of radioactive materials, which presents no real health or safety hazard, affords the scientist a most valuable opportunity to study various ecological relationships in the area utilizing tracer techniques.

The short-term effects on the environment of the thermal and radiological discharges, and the upwelling of the bottom waters, are related to the long-term productivity of the Calvert Cliffs Plant environment in that the short-term uses are being harnessed to provide key information needed to guide us in our enhancement of the long-term productivity of the area.

6.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Only that portion of the nuclear fuel which is burned up or not recovered on reprocessing is irretrievably lost to other uses. All other resources are either left undisturbed, or committed only temporarily as during construction, or during the life of the plant, and are not irreversibly or irretrievably lost.

APPENDIX A

DESCRIPTION OF CALVERT CLIFFS SITE

A.1.0 LOCATION

The site is located in Calvert County, Maryland, approximately 11 miles southeast of Prince Frederick, Maryland, and contains 1,135 acres of land and has about 10,000 lineal feet of shoreline. The site is located in a rural, sparsely populated area. The largest community within 30 miles of the site is Cambridge, Maryland, which is 22 miles from the site on the east side of the Chesapeake Bay and in 1960 had a population of 12,239. The closest major metropolitan center is Washington, D.C., which is 45 miles to the northwest. The location of the site is shown in Fig. A.1-1.

The plant is located on the eastern portion of the site abutting the Chesapeake Bay and approximately at the center of the 10,000 foot shoreline. The site plot plan is shown in Fig. A.1-2. The closest point on the property line to the reactors is 3,700 feet, and the distance to the closest permanent residence is about one mile.

SITE VICINITY

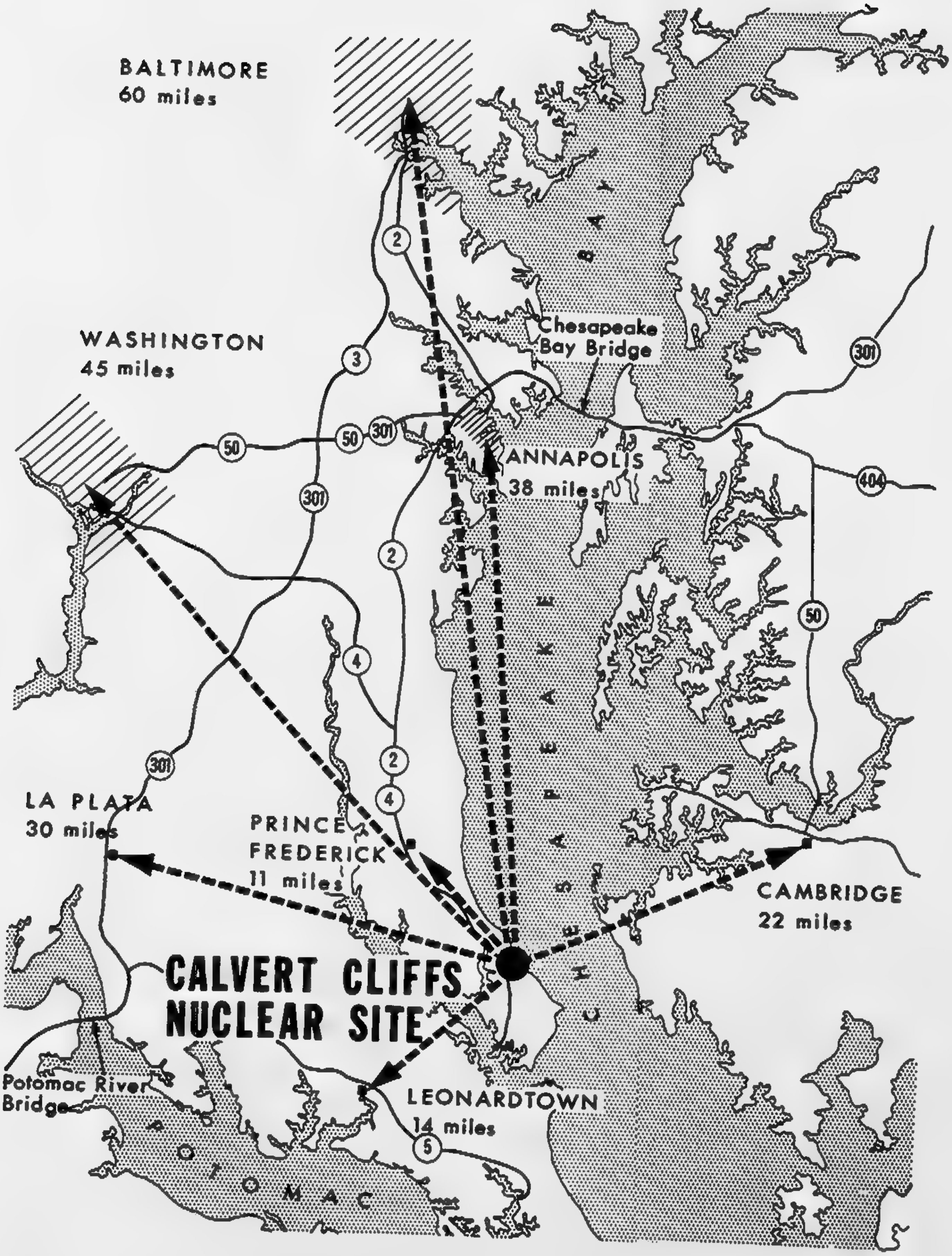


FIGURE A.1-1

SITE PLOT PLAN

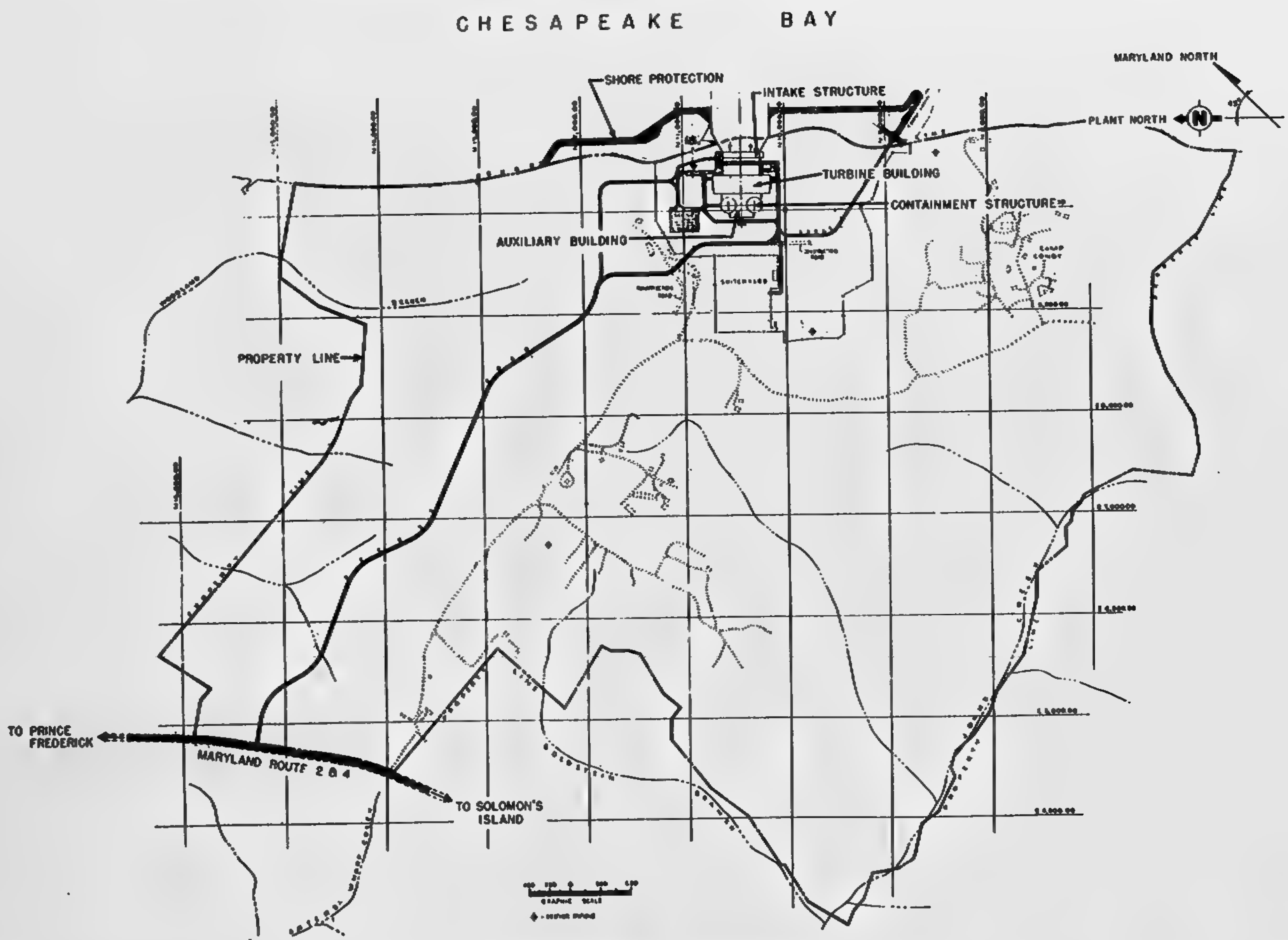


FIGURE A.1-2

A.2.0 POPULATION CHARACTERISTICS

A.2.1 Present Population

Population estimates are predicated either on planning reports prepared by the Maryland State Planning Department or extrapolation of past population trends for cities, towns, election districts and minor civil divisions. The population within each of these various political subdivisions are assumed to be uniformly distributed. All estimates include both seasonal and permanent population. (Seasonal population estimates are based on housing data from the United States Census of Housing and on residence classification data.) Population estimates within a five-mile radius of the site are based on a count of houses shown on the 1959 Calvert County General Highway Map, assuming four people per house. The estimates were extrapolated to 1965, based on the growth history of the area. House counts have been confirmed by recent aerial photographs for the immediate vicinity of the site.

The population estimates indicate that the site and surrounding area are sparsely populated with the exception of localized areas along the coast of Chesapeake Bay which attract many summer residents. The summer seasonal residents account for approximately 20 percent of the total population within 10 miles of the site. The region surrounding the site is predominantly rural in character. Table A.2.1 lists the communities within 30 miles of the site with 1960 populations greater than 1,000.

Table A.2.1

Communities Within 30 Miles of the Site With Population of 1,000 or Greater

Community	1940 Population*	1950 Population*	1960 Population*	Distance and Direction from Site (miles)
Patuxent Naval Air Test Center			1,900**	10-S
Lexington Park	***	***	7,039	12-S
Leonardtown	668	1,017	1,281	14-SW
Cambridge	10,102	10,351	12,239	21-ENE
St. Michaels	1,309	1,470	1,484	26-NNE
Waldorf	***	***	1,048	27-WNW
Easton	4,528	4,836	6,337	30-NE
La Plata	488	780	1,214	30-WNW

*Based on United States Census Bureau Statistics
**Estimated
***Population less than 1,000. Exact number not available.

The total 1965 population, including seasonal residents, within 10 miles of the site was estimated to be 13,980. The population is distributed throughout the area and includes many small communities with population less than 1,000. The County Seat, Prince Frederick, is located 10-1/2 miles northwest of the site and has a total population of about 550. The population of the larger communities located within 10 miles of the site are presented in Table A.2.2.

A new community, known as Chesapeake Ranch Estates, is located six miles south-southeast of the site. The present (1970) permanent population of this development is approximately 180. In the summer, the population is approximately 1,000 during the week, and reaches a maximum of approximately 2,000 on weekends.

Table A.2.2

Population of Communities Near the Site

Community	Estimated* 1960 Population	Distance and Direction from Site (miles)
Calvert Beach and Long Beach	850	3 -NW
Cove Point	350	4½-SE
Kenwood Beach	250	5½-NW
Scientists Cliffs	600	7 -NNW
Solomons	400	8 -S
Dares Beach	750	10 -NNW
Prince Frederick	550	10½-NW

*Based on house counts

The character of the area begins to change from rural to suburban as the major population center of metropolitan Washington, D.C., is approached. As indicated in Table A.2.3, Accumulative Population Summary, the rate of change is greatest within 10 to 20 miles of Washington, D.C., more than 30 miles from the site.

Table A.2.3

Accumulative Population Summary - 1960

Radial Distance from Site (miles)	Accumulative Population
5	3,052
10	13,980
20	75,970
30	171,490
40	441,160
50	2,372,680

A.2.2 FUTURE POPULATION

The population estimates are based on an extrapolation of the past growth history of the region and on future population estimates made by the Maryland State Planning Department.

The published future population estimates extend through 1985. These were extrapolated to 2010 for purposes of this study. In areas where the present population was less than 50, estimates of the 2010

population are based on an anticipated population density of 250 persons per square mile. This method of computation was necessary only for certain areas within 10 miles of the site. Estimates of the future development of Chesapeake Ranch Estates indicate a maximum future population of 28,000.

With continued growth of the Washington, D.C., metropolitan area, moderate population gains can be expected in the outlying regions, including portions of northern Calvert County and eastern Charles County which are within 15 to 25 miles of the site. Considerable population gains are expected in the area near Washington and Baltimore as part of the growth of the Boston to Washington "megalopolis." Table A.2.4 presents the accumulative 2010 population within various distances from the site.

Table A.2.4

Accumulative Population Summary

Radial Distance from Site (miles)	Accumulative 2010 Population
5	11,253
10	59,750
20	187,470
30	379,830
40	1,040,750
50	4,757,810

A.3.0 LAND USE CHARACTERISTICS

In 1959, 85,400 acres (61 percent) of land in Calvert County was devoted to farms, 51,200 acres (36.5 percent) to forests, and 3,500 acres (2.5 percent) to other uses. Of the 3,500 acres not used for farms or occupied by forests, 79 percent was residential; 5 percent was commercial; 3 percent was industrial; and 13 percent was devoted to public and semi-public use.

Approximately 18,800 acres (22 percent) of the farmland was harvested cropland, of which the major portion was used for growing tobacco, corn and hay.

The percentage of land in Calvert County devoted to farms declined to 53.3 percent in 1964. With continued population growth, it is anticipated that the percentage of land devoted to farms will continue to decline and will be accompanied by increased residential and commercial use. However, the overall character of the area is expected to remain essentially rural.

At the present time, the major portion of the land in the area surrounding the site is devoted to agricultural and forest uses. Although the amount of land devoted to farming is declining, agriculture should continue to remain the primary land use during the life of the Calvert Cliffs Nuclear Power Plant.

Dairy farming is of minor importance in Calvert County. In 1959, there were five dairy farms in the county and in 1964 the number decreased to one.

The waters adjacent to the site are used for commercial fishing, primarily shellfish, such as clams and oysters, and for crabs. Calvert County accounted for approximately 2 percent of the state's total fish catch in 1963.

A.4.0 GEOLOGY

The site lies within the Coastal Plain Physiographic Province and is underlain by approximately 2,500 feet of southeasterly dipping sedimentary strata of Cretaceous and Tertiary age. Underlying these sediments are crystalline and metamorphic rocks of Precambrian and Early Paleozoic age.

Sediments of the Chesapeake group of Miocene age underlie the proposed plant area to a depth of about 200 feet. The material in this group consists essentially of horizontally stratified sandy and clayey silt with occasional interbeds of sands and shells. It is relatively impervious and dense and will provide adequate foundation support for the power plant. The Miocene sediments are underlain by dense relatively pervious glauconitic sand and silt of the Eocene age.

No known or suspected faults are present in the sedimentary strata underlying the site. The closest known faults are located in the Piedmont Province in western Maryland, approximately 50 miles from the site.

The rate of shoreline recession, due to erosion along the cliffs on the eastern periphery of the site, ranges up to about two feet per year. Appropriate measures have been taken to control future shoreline recession in the plant area.

A.5.0 GROUND WATER HYDROLOGY

The site is well drained and not susceptible to flooding. Surface runoff is moderately high and accounts for about 35 percent of the total annual precipitation. Average annual precipitation in the region ranges from about 40.6 inches at the Patuxent Naval Air Test Center to about 44 inches at Prince Frederick. A drainage divide extends across the site in a general north-south direction. The area east of the divide (20 percent of the site) drains into the Chesapeake Bay, whereas the area to the west drains into local tributaries and eventually into the Patuxent River. The plant is located east of the divide where surface drainage is toward the Chesapeake Bay. Grading at the plant site will improve surface drainage and will facilitate runoff into Chesapeake Bay.

The plant area is underlain by over 200 feet of relatively impermeable sandy and clayey silt of the Chesapeake group. This impermeable deposit effectively confines the underlying artesian aquifers and minimizes their possible contamination by the downward percolation of an accidentally discharged contaminated liquid. The vertical component of ground-water movement through the Chesapeake group is upward. This precludes the possibility of contamination of the aquifers due to downward percolation of a contaminant.

Most of the potable water used in the region is obtained from artesian aquifers underlying the Chesapeake group. The aquifers are composed of glauconitic sand and silt of the Piney Point, Nanjemoy and Aquia formations. The piezometric surfaces of these water-bearing formations slope to the southeast at about two feet per mile. Based upon this hydraulic gradient and coefficients of permeability for these formations, the estimated average rate of natural ground-water movement is less than one inch per day.

A limited quantity of potable water is obtained from shallow wells completed in the surficial Pleistocene deposits which overlie the Chesapeake group throughout most of the area surrounding the site. The areas in which these materials are utilized as a source of water are upgradient from the plant, and cannot be affected by the accidental release of contaminated liquids at or below the ground surface in the plant area.

The possibility of adversely affecting the available groundwater resources or existing wells in the area by the construction and operation of a nuclear power plant is remote.

A.6.0 OCEANOGRAPHY

A.6.1 Chesapeake Bay - Its Size and Form

The Chesapeake Bay is a drowned river valley estuary. It is a relative newcomer to the area, being only about 10,000 years old. During the last rise in sea level, which was caused by a warming of the climate and the resultant glacial melt, the valley system of the Susquehanna River was flooded forming the Chesapeake Bay. As an estuary, the Bay has a free connection with the open sea and a noticeable dilution of salt water by overland freshwater runoff.

The Chesapeake Bay is approximately 195 miles long, varying in width from 3 to 35 miles with a mean width of about 15 miles. Since it is a submerged river valley system, its coastal outline is most irregular - a succession of points and bays with occasional islands. The Bay has about 150 tributaries and a total shoreline in the neighborhood of 4,600 miles. Its drainage basin includes an area of some 64,000 square miles. In essence the Bay resembles a very shallow pan that is creased by a narrow channel. Although the channel is as deep as 120 feet, the mean depth of the Bay is only on the order of 25 to 30 feet in spite of its imposing dimensions.

The Chesapeake Bay at the Calvert Cliffs plant site is about six miles wide from the western shore to Taylors Island. Although the channel is as deep as 101 feet in the area, half of the water lies between the surface and a depth of 30 feet. The site of the Calvert Cliffs Nuclear Power Plant is approximately halfway between the mouth of the Bay and its headwaters at the Susquehanna River.

A.6.2 Salinity Distribution

Dr. Donald W. Pritchard (1) has pointed out that the salt content of the Bay waters varies in a more or less regular manner along the length of the Bay, from that of nearly full sea water at the mouth to that of the inflowing Susquehanna River water at the head of the Bay. Characteristically, the vertical variation in salinity shows an upper layer of very slow increase with depth, an intermediate layer of more rapid increase (called the halocline) and a deep layer in which again the salinity increase with depth is small. The salt content also varies across the Bay with lower salinities on the western side of the Bay and higher salinities along the Eastern Shore. Although the greater runoff of fresh water from the western shore contributes to this lateral difference, the major cause of this variation involves the influence of the earth's rotation.

The minimum salinities occur in spring and maximum salinities in autumn when low but measurable ocean-derived salt concentrations extend onto the Susquehanna Flats.

The intensity of the vertical variation in salinity also varies seasonally, with the largest vertical gradient in spring and the weakest vertical gradient in autumn. Average vertical differences in salinity between the surface and 40 feet are: winter, 3.2%; spring, 5.2%; summer, 4.6%; autumn, 2.1%. The vertical variation is, however, highly variable in time and space within any season, depending to a large extent on recent local weather. Consequently temporal and spacial variations within any one season may exceed the range of the average seasonal vertical gradients.

(1) Chemical and Physical Oceanography of the Bay, Proceedings of the Governor's Conference on Chesapeake Bay, September 12-13, 1968.

A.6.3 Circulation Pattern

The oscillatory flood and ebb of the tidal currents are the most obvious water motions in the Bay and its tributary estuaries. Average maximum tidal currents in mid-channel of the Bay range from 0.5 knot to over 2 knots. In general, the tidal currents are strong near the mouth of the Bay, decrease in the middle reach, and increase again in the upper Bay. Constricted sections have higher tidal current velocities than is otherwise characteristic for the particular reach of the Bay in which they occur. The tidal currents provide the energy for the mixing of the ocean water and fresh water in the Bay, but do not provide for a net transport of water or of dissolved and suspended materials. Superimposed on the oscillatory tidal currents is a net non-tidal circulation pattern which is characterized by a seaward flow in the upper layers and a flow directed up the estuary in the deeper layers. The speed of this net non-tidal flow is only on the order of one-fifth the magnitude of the tidal currents, and hence the observed combination of the tidal currents with the net non-tidal flow results in an apparent ebb current at the surface which is longer and stronger than the ebb current near the bottom.

In the deeper sections of the Bay, the depth above which the net flow is directed down the Bay, and below which the net flow is directed up the Bay, is more likely to be on the order of 20 feet or so. Because of the effects of the earth's rotation, the surface of no net motion will vary across the Bay, being deeper on the western side than on the eastern side. Thus the layer of net seaward drift extends to greater depths on the right-hand side of the estuary looking seaward, while the layers with a net flow up the estuary extend nearer the surface on the left-side of the estuary. The slope of this surface may in some instances become sufficiently great

so as to intercept the surface. In this case, there will be a segment along the left side of the estuary in which there is a net flow toward the head of the estuary at all depths, and a segment along the right hand side of the estuary in which there is a net seaward flow at all depths.

In order to preserve continuity, the water which flows into and up the Bay in the deeper layers must be returned seaward in the upper layers. Consequently there must be a net vertical flow directed from the deeper layers into the surface layers. Although the speed of this net vertical flow is quite small (on the order of a few hundred-thousandths of a knot), the area of the horizontal plane through which this flow is occurring is sufficiently large so that the net volume rate of flow is quite large.

The net non-tidal circulation pattern represents long-time average conditions. The estuary may depart from this pattern significantly in local regions for short periods of time -- i.e., for several days. For example, meteorologically induced flows can reverse the pattern temporarily. Under certain wind and atmospheric pressure conditions, abnormally high mean water levels can occur in the Bay, with tidal levels as much as 6 feet above normal in the upper Bay, although more typically such meteorological tides are of the order of 3 feet above normal. In any case, when the wind and pressure forces causing this abnormal condition cease, the excess water in the upper Bay must flow seaward.

A.6.4 Dissolved Oxygen

Dissolved oxygen is added to the water by exchange across the air-water interface and by photosynthesis, and is removed from the water by loss across the air-water interface, by respiration of living organisms, and by decay of organic material. During winter the Bay is uniformly high in dissolved oxygen content. With increase in the temperature of the

Bay waters in spring, the dissolved oxygen content decreases as a result of the decrease in the saturation value with temperature. The surface values stay near saturation, but below the halocline the oxygen decreases at a faster rate than at the surface, becoming significantly less than the saturation value. This is because the metabolic rate of utilization of oxygen increases with rising temperature, and because the intensity of vertical mixing decreases during the spring period. By mid-June the dissolved oxygen concentrations in the deeper waters of the Bay may be less than 1 ml/l, while the surface values are above 5 ml/l. This condition continues through the summer months, with the dissolved oxygen content at 40 feet and below sometimes having values of less than 0.1 ml/l.

In later summer, usually after the middle of August, rapid changes in the vertical distribution of dissolved oxygen often occur. A few clear, cool nights will lead to rapid downward mixing and hence replenishment of the dissolved oxygen in the deeper waters. A subsequent warm spell can re-establish a strong vertical density gradient and the oxygen in the deeper waters will again decrease. By the middle of October the oxygen at all depths has started a steady increase, and shortly thereafter the Bay becomes nearly uniform in dissolved oxygen concentration.

A.7.0 METEOROLOGICAL CHARACTERISTICS

During the operation of nuclear power plants, periodic but small amounts of radioactive inert gases can be satisfactorily dispersed into the atmosphere without having any adverse effects on the area or its inhabitants.

To determine the dispersion conditions at the Calvert Cliffs site, meteorological studies were carried out prior to selection of the site. Subsequent to the decision to construct a plant, a more comprehensive pre-operational program was begun. The preliminary studies consisted of site visits by experienced meteorologists, and the computer analysis of five years of hourly observations of meteorological data from the Patuxent Naval Air Station only 10 miles from the site, and also on the Western Shore of the Chesapeake Bay. Since the topography of the Patuxent Station is relatively low and flat as compared to the Calvert Cliffs site, and is located at a point with water on two sides, it was recognized that some differences in atmospheric transport and diffusion were likely, in spite of the proximity of the two sites. Therefore, as soon as the site became available, meteorological instrumentation was installed in various locations on site to verify and/or adjust the predicted dilution capabilities.

A.7.1 Climatology

The climate of the Chesapeake Bay Area is marked by generally mild winters and summers. The Chesapeake Bay absorbs much of the sun's heat during the day and releases some of it during the night when the air above the water becomes cooler. The average annual temperature at Calvert Cliffs is about 57.5 F, as compared to 54 F in Baltimore and 55 F in Washington. The evaporation of the surface water of the Bay increases the humidity of the air.

The average maximum air temperatures range from a peak of 85 F

in late June or early July to 70 F for the highest minimum summer temperature. The range in the coldest part of winter is 30 to 45 F. Approximately 70 days occur when the temperatures reach below freezing.

The annual mean precipitation is about 42 inches, with the largest amounts in July and the smallest in November. Snowfall averages only about 15 inches per year.

The area lies in the belt of "prevailing westerlies" so that most of the weather comes from a more or less westerly direction across the continental United States, or directly from Canada. Cold air masses, such as produce the colder days of winter and the cool days of summer, come generally from the northwest. Warm air masses originate either in the desert and plateau sections of the southwestern states and Mexico, or from over the Gulf of Mexico. Those from the Gulf generally produce considerable precipitation, while those from the desert regions generally produce warm or hot, dry periods.

Northwesterly winds prevail from October to April, and southwesterly winds prevail in the warmer months. Ordinarily, the velocity of the wind varies directly with the intensity of the low pressure area and inversely with the distance from its center. The usual diurnal variations in wind speed occur with a minimum generally before dawn, increasing with the daily temperature to a maximum at the time of highest temperature. High winds of destructive velocity are rare.

A.7.1.1 Tornadoes

Five tornadoes were observed during the period 1953-1962 in the general vicinity of a single latitude-longitude square near the proposed plant site. The mean annual frequency was 0.5 tornado per year and the probability of a tornado striking a single point within a single latitude-

longitude square near Calvert Cliffs, (using a method originally derived by H.C.S. Thom of ESSA) was calculated to be 3.75×10^{-4}. The recurrence frequency was calculated to be once about every 2,700 years.

A.7.1.2 Thunderstorms

Thunderstorm day statistics indicate that about 40 thunderstorms per year can be expected in the area. Fifteen years of record at Patuxent indicate 814 observations showing thunderstorm indications. From these data one can calculate the average duration of a thunderstorm to be 1.356 hours for a point. A study of ten years of record for transmission feeders and subtransmission feeders was conducted. This study showed that transmission and subtransmission losses were 4 minutes and 423 minutes, respectively, due to storms in a 10-year period. The subtransmission feeders covered an area approximately 180 square miles.

A.7.1.3 Freezing Precipitation

The Patuxent Naval Air Test Center records (1949-1964) list 910 hours of snow and 265 hours of frozen or freezing precipitation, other than snow, a total of 1175 hours or 70,500 minutes in 15 years. Interpolating for a 10-year span yields 47,000 minutes. The outages due to snow and/or freezing precipitation were 182 minutes and 122 minutes in 10 years, for transmission and subtransmission feeders, respectively. It is interesting to note that 9 of 12 outages occurred during a single snowstorm in March, 1958. Certain design changes were made as a result of this storm and it is unlikely that outages of this magnitude would again occur.

A.7.1.4 Tropical Storms and Hurricanes

Approximately one hurricane per year poses a threat to the area and about one hurricane every 10 years produces a significant effect in the area. Northeasters, or extra-tropical storms, also can influence the area in terms of flooding of low-lying land. The detrimental effects of

northeasters are considerably less than those postulated for hurricanes in the site area.

A.7.2 Meteorological Program Methods and Results

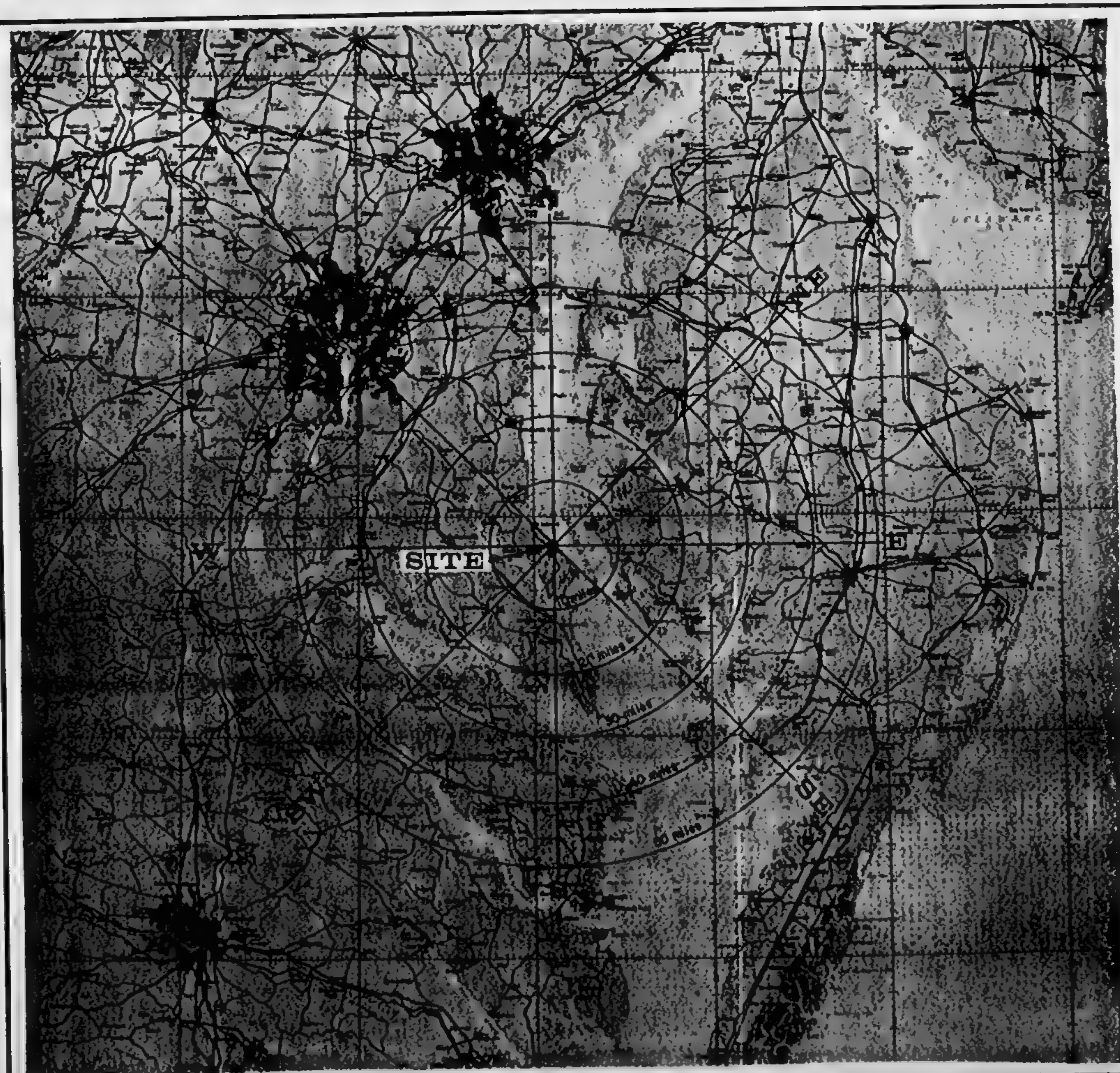
A regional map is shown in Figure A.7-1. Besides the 5 years of data, an additional 10 years of records were processed, making a total of 15 years for the Patuxent Naval Air Station (PAX). In addition, data from the Washington National Airport (DCA), Byrd Field in Richmond, (RIC) and from Annapolis, Maryland (ANA) were used to evaluate the frequency of occurrence of various weather parameters and meteorological extremes. Statistical data for severe weather were obtained from the Environmental Science Services Administration (ESSA). These sources yielded data on generalized wind and diffusion conditions, tornadoes, freezing precipitation, tropical storms, etc.

A.7.2.1 Preliminary On-Site Data

The preliminary on-site data collection program at Calvert Cliffs began in September, 1967. Data on the instruments and their locations are shown in Table A.7.1 and on Figure A.7-2.

These on-site measurements for the period November 9, 1967, through November 9, 1968, showed the following:

1. Frequency of inversions - 31%.
2. Air drainage was toward the Bay under inversion conditions.
3. Average wind speed during inversions was 2.6 meters per second.
4. The standard deviation of horizontal wind direction (σ_θ) during the worst single season and wind sector inversion conditions averaged 6.6°.
5. In general, when wind speed decreased, σ_θ increased.
6. For on and along-shore winds, the average value of the product of sigma theta and mean wind speed ($\sigma_\theta \bar{u}$) was 0.209 radian meter/sec.



REGIONAL MAP

STATUTE MILES
10 0 10 20

REFERENCE:
THIS MAP WAS PREPARED FROM THE FOLLOWING USGS SECTIONAL AERONAUTICAL CHARTS: WASHINGTON AND NORFOLK.

FIGURE A.7-1

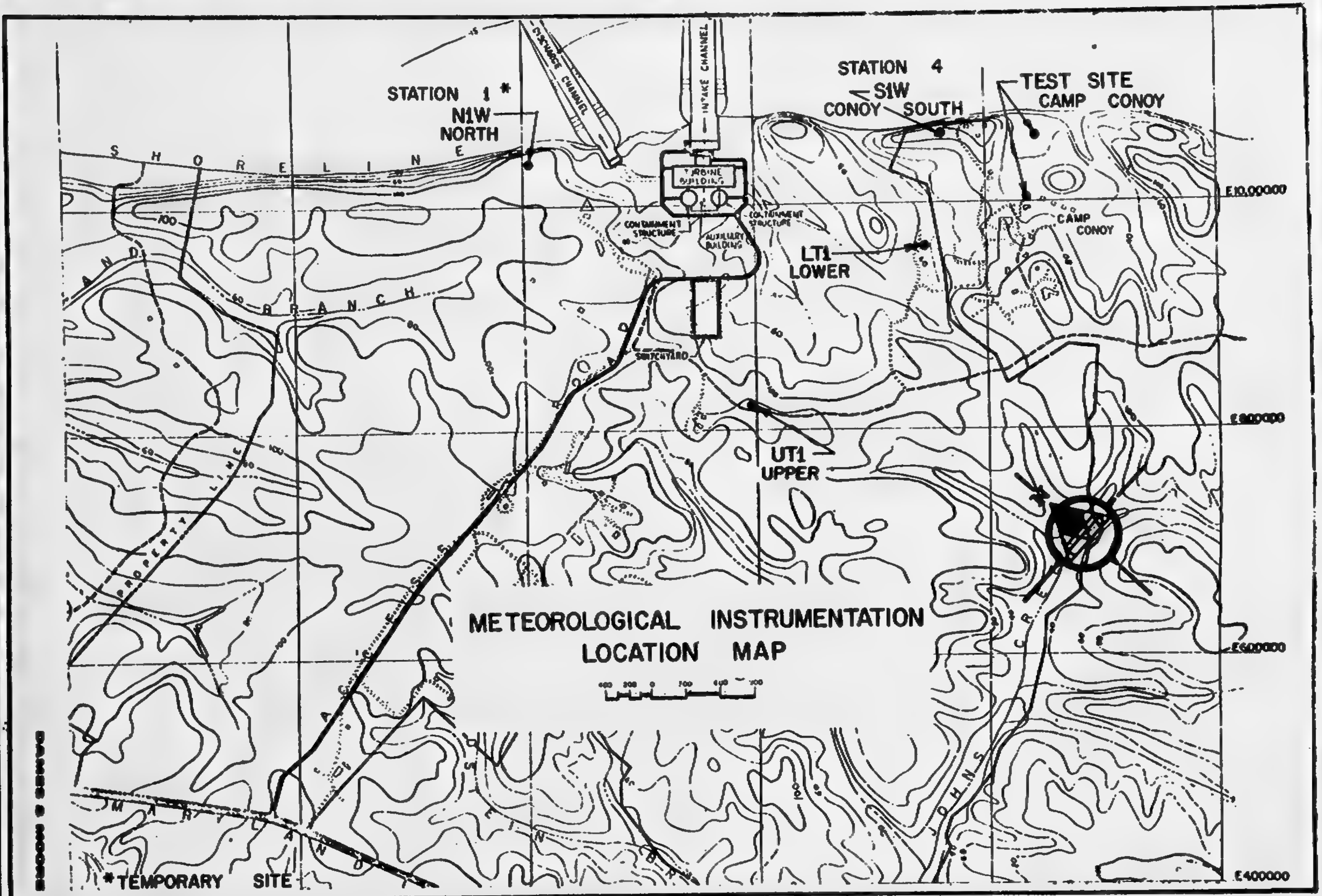

STATION 1 *
N1W
NORTH
STATION 4
S1W
CONOY
SOUTH
TEST SITE
CAMP CONOY
DISCHARGE CHANNEL
INTAKE CHANNEL
TURBINE BUILDING
CONTAINMENT STRUCTURE
CONTAINMENT STRUCTURE
AUXILIARY BUILDING
SWITCHYARD
CAMP CONOY
LT1
LOWER
UT1
UPPER
SHORELINE
PROPERTY LINE
E10,000.00
E800000
E600000
E400000
METEOROLOGICAL INSTRUMENTATION
LOCATION MAP
*TEMPORARY SITE
DAMES & MOORE

FIGURE A.7-2

TABLE A.7.1

FIRST YEAR ON-SITE METEORLOGICAL STATIONS AND INSTRUMENTATION

CALVERT CLIFFS NUCLEAR POWER PLANT

DESIGNATION	LOCATION	ELEVATION	PERIOD	INSTRUMENTATION
Station 1* "N1W" North	N220,640 E958,930 Md. Grid	100' MSL +10' Mast	(1) 09/04/67 - 11/11/68 (2) 12/14/67 - 11/11/68	(1) Packard Bell Electronics (Beckman-Whitley,Inc.) Model K-100 with Quick-D Vane Wind System and (2) Standard US Weather Bureau Rain & Snow Gauge
Station 4 "S1W" Conoy South	N8,400 E1,060,000	90' MSL +50' Mast	11/09/67 to 01/10/69	Packard Bell Electronics Corporation (Beckman-Whitley,Inc.) Model K-101 with Quick-D Vane Wind System
Station UT1 Upper	N217,700 E958,700 Md. grid	120' MSL +4' Shelter	11/09/67 to 12/31/68	Science Associates, Incorporated Thermograph, No. 156 installed in standard US Weather Bureau Cotton-Region type shelter
Station LT1 Lower	N217,750 E960,670 Md. grid	40' MSL +4' Shelter	11/09/67 to 12/31/68	Same as Station UT1
Test Site Camp Conoy	N7,600 E1,055,000 N7,625 E1,000,000	(1) 40' MSL +12' Masts (3) 60' MSL	(1) 10/17/68 - (2) 11/01/68 & (3)	(1) Meteorology Research, Inc. (MRI) Mechanical Weather Station Model 1072 with rain gauge; (2) MRI vector vane Sigma Meter model 1053-Mark II and (3) A second MRI model 1071-no rain gauge

* Temporary Location

7. The relative concentration, X/Q, at the 0.5% frequency level of all conditions was 1.17×10^{-4} sec/M^3 evaluated at 1150 meters, the distance to the nearest site boundary.

A.7.2.2 Special Tests

In the fall and winter periods, two sets of special tests were carried out to explore the vertical standard deviation of the wind direction (σ_e). Test set No. 1 was conducted at Camp Conoy (see Fig. A.7-2) from October 17 to November 1, 1968. To simulate the proposed reactor location, an anemometer was set up on a 40-foot bluff south of the reactor site. From this instrument the wind direction, wind speed and sigma theta were obtained. In addition, a vector vane instrument to determine σ_e was operated.

These tests showed the following results:

Test Set 1

	On-shore Inversion Wind	Off-shore Inversion Wind	"Neutral" Winds
Cases	16	122	157
$\overline{\sigma_e}$	13°	8°	14.3°
Lowest σ_e	1°	1°	1°
Cases<5°	1	35	9

Test Set 2 (February 11 through 20, 1969)

A second set of readings was taken during this period at Station 2 (about 2000 feet from the coastline). The companion statistics for Test Set 2 were as follows:

	On-shore Inversion Wind	Off-shore Inversion Wind	"Neutral" Winds
Cases	36	28	104
$\overline{\sigma_e}$	10°	13°	6°
Lowest σ_e	6°	2°	4°
Cases < 5°	0	5	1

These readings were also taken about 10 to 12 feet above the ground but with an unobstructed trajectory from an on-shore viewpoint.

The sigma e values measured during these two test series both indicated that:

1. On-shore inversion winds tend to produce near-neutral (Pasquill "D") σ_e values.

2. Off-shore inversion winds tend to produce lower standard deviations than on-shore cases near the coast but somewhat larger inland.

3. Only one (1) case in the total showed σ_e values as low as Pasquill "F".

Since Station 4, at Camp Conoy, was located only about 50 feet inland from the edge of the cliff overlooking the Bay, there was some concern expressed that the wind speed for on-shore flow at the Station 4 (S1W) site was not representative for inland locations because the anemometer is in an area that is subject to a "venturi" effect when the wind direction is on-shore. This study compared the wind speed and diffusion values at the Station 4 (S1W) site to those on a raft anchored about one mile off-shore in order to explore this possibility.

For approximately one month of data, the diffusion parameter (STUB) was compared at each site where simultaneous on-shore flow occurred at the sites. The average wind speeds at the two sites were also compared.

Table A.7.2 gives the results of the 256 simultaneous on-shore winds and compares them to the classical Pasquill inversion classification values. The data indicated the following:

1. Only one observation of 256 at S1W gave a $\sigma_{\bar{u}}$ value equivalent to Pasquill "F".

2. Wind speeds were generally lower at S1W than at the raft, but wind deviations were larger.

3. The only possible venturi effect noted at S1W was when the wind was on-shore and the speeds were 3 mph or less.

Table A.7.2

Results of 256 Simultaneous On-Shore Winds in Raft Study as Compared to Classical Pasquill Inversion Class Values

Site Pasquill Class	Avg. (rad. m/sec.)	Avg. (m/sec.)	Avg. (degrees)
Raft	0.534	4.23 (9.5 mph)	7.2
Station 4 (S1W)	0.492	3.41 (7.6 mph)	8.3
Classical "F"	0.044	1.00 (2.2 mph)	2.5
Classical "E"	0.175	2.00 (4.5 mph)	5.0

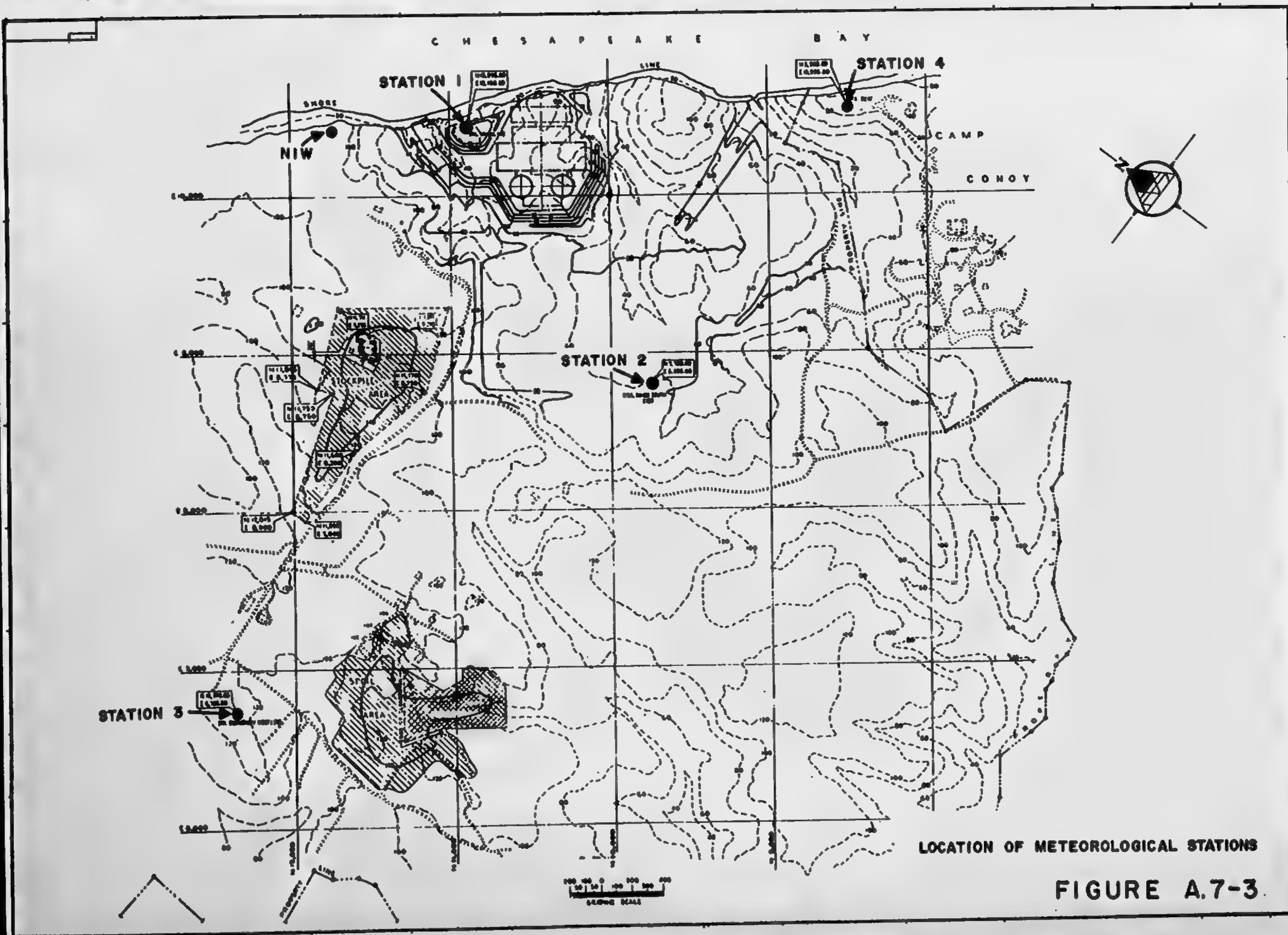
A.7.2.3 Extended On-Site Program

In January, 1969, the on-site meteorological investigations were extended to examine the penetration of on-shore winds inland. The northern anemometer site (No. 1) was moved south to a knoll close to the reactor location. Two additional stations were set up, one about 2000 feet south of the reactor (Station 2) and another (Station 3) farther to the west at a distance approximately equal to the distance to the nearest site boundary (3800 feet). Station 4 was retained in the network. These stations were activated January 10, 1969. In May, 1969, temperature gradient systems were added to Stations 2 and 4. Table A.7.3 and Figure A.7-3 show instrumentation and locations of the extended network. In August, 1969, a newly developed wind system became available and was tested extensively in parallel with the existing system at Station 2.

A.7.2.4 Method of Analysis

A computer program was developed to analyze the wind flow across the network using the simultaneous observations from the four stations.

The program classified the hourly data into 96 statistical tables, grouped by wind speed class, stability class, wind direction, sector,



LOCATION OF METEOROLOGICAL STATIONS

FIGURE A.7-3

TABLE A.7.3

R&D ON-SITE METEOROLOGICAL STATIONS AND INSTRUMENTATION
CALVERT CLIFFS NUCLEAR POWER PLANT

DESIGNATION	LOCATION	ELEVATION	PERIOD	INSTRUMENTATION
Station 1 "K" Knoll	N10,895 E10,435	48'MSL +12'Mast	1/3/69 to present	Meteorology Research, Inc. (MRI) Mechanical Weather Station, Model 1072, wind system with precipitation gauge.
Station 2 "IS" Inner South	N9,530 E8,720	48'MSL+12' Mast & a 48'MSL+12' & 49.5 48'MSL+33'	1/9/69-1/12/70 2/11/69-2/20/69 5/15/69-present 6/16/69-8/7/69 8/7/69-present	MRI Mechanical Weather Station, Model 1071 - no precipitation gauge. MRI Vector Vane Sigma Meter Model 1053 - Mark II. Packard Bell Electronic Corp. (Beckman-Whitley, Inc.) Model 327 Temperature Gradient System. MRI, Model 2040 Wind Diffusion System.
Station 3 "BW" Boundary West	N12,375 E6,735	115'MSL +10'Mast	1/9/69-1/11/70	MRI, Mechanical Weather Station, Model 1071 - no precipitation gauge.
Station 4 "SIW" Conoy South	N8,500 E10,550	90'MSL+50' Mast; 90'MSL +49'&12'	1/10/69-present	Packard Bell Electronic Corp. (Beckman-Whitley, Inc.) Model K-101 with Quick-D Vane Wind System and Packard Bell Model 327 Temperature Gradient System.

and the parameter $\sigma_\theta \bar{u}$, the product of mean wind speed and standard deviation of the azimuthal winds. Standard techniques for evaluation of short-term releases were compared with measured data to determine the actual values for these locations. To be conservative, those hours were selected when the wind at Station 1 was blowing on or along shore and when the values of $\sigma_\theta \bar{u}$ were below 0.200 radian-meter per second for at least two of the four stations.

A.7.2.5 Results

Results for the one-year extended study showed inverstion conditions for 35% of the total observations, neutral conditions for 47%, and lapse conditions for 17%, with 1% of the observations missing. Again, it was confirmed that the winds showed a definite tendency to drain off-shore during inversions. For the on-shore winds, nearly 18% were in the neutral category, 9% in the unstable, and less than 4% in the stable category.

A.7.3 Calculation of Relative Concentrations

For the first two hours following a postulated ground level continuous release, the relative concentration is calculated by the Gifford wake model equation:

$$\frac{X}{Q} = \frac{1}{\bar{u}\ (\pi \sigma_y \sigma_z + cA)}$$

where

X/Q = relative concentration, seconds/M^3

$\bar{u}$ = average wind speed, meters/sec.

σ_y, σ_z = standard deviations of the distributed material in the lateral and vertical directions, in meters

c = wake factor (dimensionless)

A = cross-sectional area of structure from which material is presumed to be released, square meters.

Among the data calculated for the four stations were the cumulative frequency distribution in percent of total observations for the various wind speed categories. From these data it was determined that 5% of the time the on along shore winds at Station 1 had speeds of 3.2 meters per second, or less; the 5% level for Stations 2, 3, and 4 were 1.1 mps, 1.7 mps, and 2.1 mps, respectively. The average of the four stations at the 5% level is 2.0 meters per second. However, for additional conservatism, it is assumed that the wind speed will be only 1.0 meter per second.

The relative concentration was evaluated using the Gifford equation at various frequency levels of the parameter $\sigma_\theta \bar{u}$, using another very conservative technique. This was to select the average of the two lowest of the four simultaneous values $\sigma_\theta \bar{u}$ observed for on along shore winds, and to array these averages in the order of frequency of occurrence. Using a wind speed of 1 meter per second, the corresponding values of σ_θ were tabulated, and the corresponding values of σ_y for a distance of 1150 meters (nearest site boundary) were selected. A wake factor of cA = 0.5 x 1640 M^2 = 820 M^2, and σ_z of 24 meters were used. The previous measurements of σ_θ using the vector vane show this value also to be highly conservative. With these highly conservative assumptions, the short-term X/Q at the 5% frequency level was 1.29 x 10^{-4} sec/M^3. For longer time periods, calculations of the cumulative frequency distribution of X/Q values for each of the 16 sectors of the compass were made, assuming the minimum site boundary distance of 1150 meters applied. Station 4, the meteorological station with the lowest $\sigma_\theta \bar{u}$ value, was selected, and only Pasquill-Turner Classes D, E and F were considered. The relative concentration values for the 5% level were found to be:

Time Period	X/Q at 1150 Meters
0-2 hours	1.29×10^{-4} sec/M^3
2-24 hours	9.1×10^{-6}
1-30 days	2.7×10^{-6}

Values of X/Q at other distances are shown on Figure A.7-4.

The long-term value (annual average) relative concentration was calculated for each sector, again using the minimum site boundary distance of 1150 meters, and using no wake factor. The highest value was for the southern sector (and was 1.61×10^{-6} sec/M^3). Figure A.7-5 shows the annual average values of X/Q for different wind sectors at Calvert Cliffs.

A.7.4 Continuing Studies

Continuing measurements are being made at Stations 2 and 4 to further refine the diffusion parameters, and to observe any significant changes that might be associated with construction of the plant. Since routine releases will normally be through a vent near the top of the containment structures, a taller meteorological instrument tower is being installed to probe the important parameters at higher elevations as well. This tower will be erected in the vicinity of Station 2. It is intended that the new tower will be instrumented with thermal gradient systems and with devices capable of measuring both the vertical and horizontal variations in wind direction, as well as the more common parameters.

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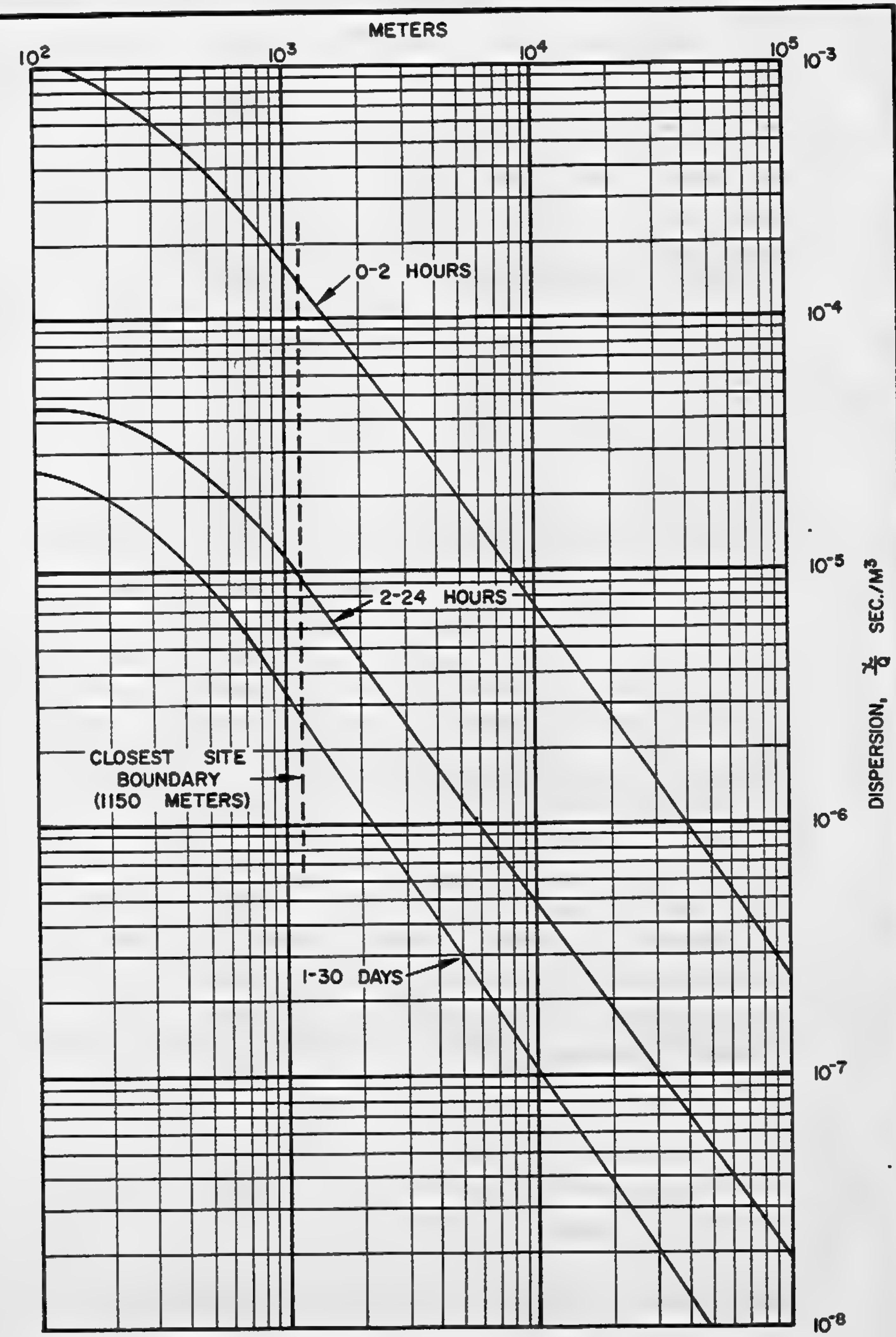
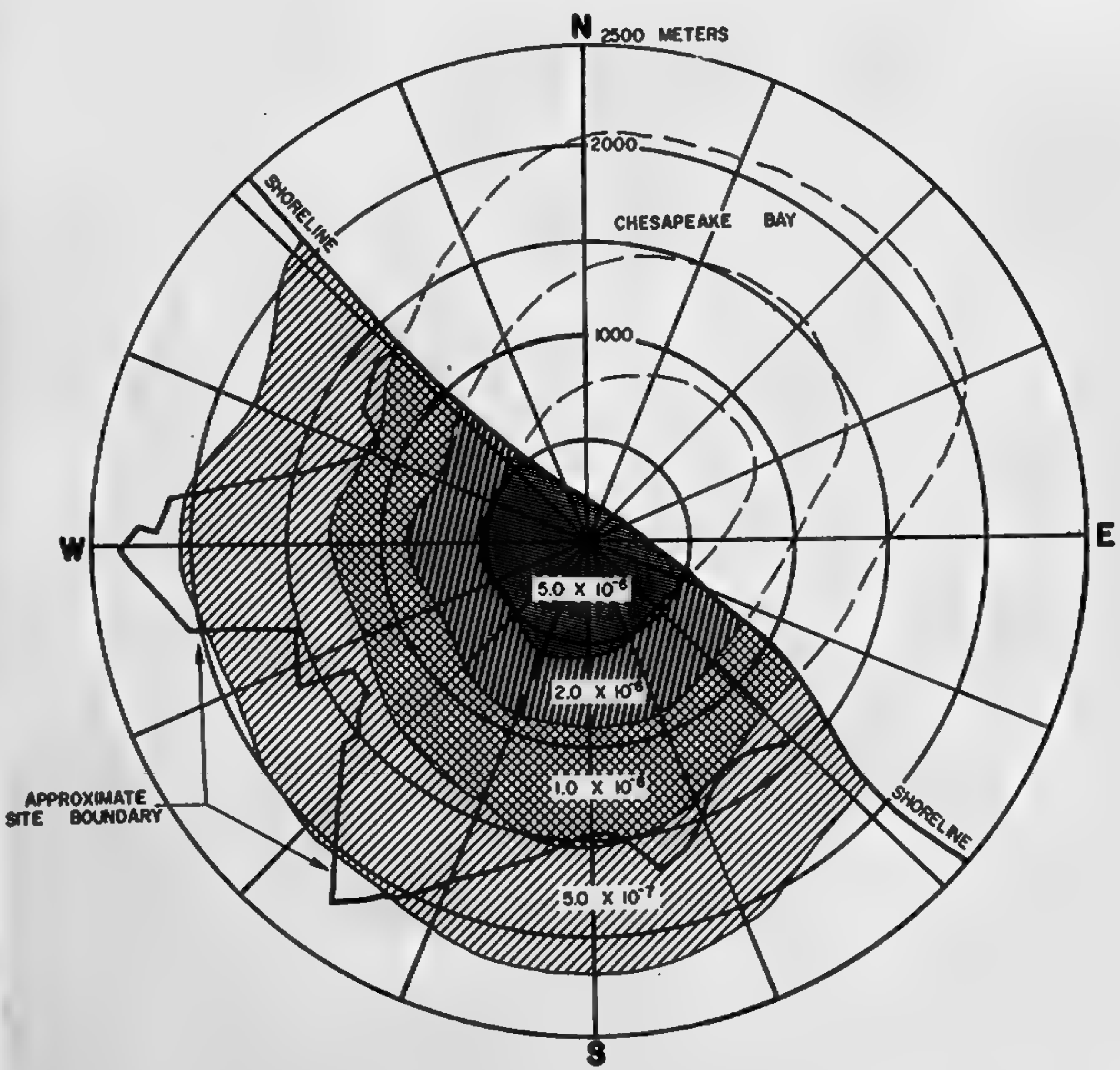


RELATIVE CONCENTRATION AS A FUNCTION OF DISTANCE FROM RELEASE POINT

DAMES & MOORE

946.P(REV. 6-61)

FIGURE A.7-4



AVERAGE ANNUAL VENTING RELATIVE CONCENTRATION

FIGURE A.7-5

APPENDIX B

DESCRIPTION OF PLANT EFFLUENT AND WASTE SYSTEMS

B.1.0 CONDENSER COOLING WATER SYSTEM

The design of the condensers and the intake and discharge structures was based on the criteria stated in Section 2.2.3 to produce as little change as possible in the ecosystem of the Bay from operation of the plant.

B.1.1 Temperature Rise in Condenser

The condensers for both of the electrical generating units have been specified and are being designed such that the increase in temperature of the Chesapeake Bay water passing through the condensers will be 10 F at maximum expected operating conditions.

B.1.2 Cooling Water Flow

The amount of Chesapeake Bay water which will be required for condenser cooling purposes is 1,200,000 gallons per minute per unit, or a total of 2,400,000 gallons per minute (about 5,350 cubic feet per second) for both units.

There will be an additional requirement for Bay water in the amount of 31,000 gallons per minute per unit, or a total of 62,000 gallons per minute for the plant (about 140 cubic feet per second). This water will be pumped through closed tube heat exchangers and thus provide a cooling medium for other smaller closed cooling water systems in the plant. The temperature rise of this water will be about 8 F under normal full load operating conditions.

The total cooling water for the plant will be about 5,490 cubic feet per second. This quantity of water is approximately 0.7 percent of the average tidal flow in the area of the plant and only about 6 percent of the flow of new water past the plant as discussed in Section 2.2.1.

B.1.3 Cooling Water Intake

The design of the proposed cooling water intake system incorporates a curtain wall, as shown in Figures B.1-1 and B.1-2 which is essentially in line with the extended shoreline that has been provided for shore protection. This wall extends across the full width of the intake channel, a distance of approximately 560 feet. The top of this wall is approximately 5 feet above the water and the bottom is at elevation (-)28 feet. The purpose of this wall is to assure that essentially all of the Bay water taken into the plant is drawn from the lower strata of that area of the Bay. The velocity of the water passing below this wall will be less than one-half foot per second.

The bottom of the intake channel under the curtain wall will be at elevation (-)51 feet. From the curtain wall eastward, the channel bottom remains at elevation (-)51 feet for approximately 850 feet and then slopes gently upward over a distance of approximately 1100 feet until it reaches an elevation of (-)40 feet. The channel then extends another 2500 feet to the east at which point it meets the natural (-)40 feet contour. Thus, the intake channel extends a total distance of approximately 4500 feet to the east of the curtain wall out into the Bay. The width of the bottom of the channel is 560 feet for a distance of about 1950 feet from the baffle wall then averages about 400 feet for the remainder of the channel. The channel sides will be sloped to a ratio of 5:1.

From the curtain wall westward toward the plant, the bottom of the channel will slope upward to meet the bottom of the intake structure at elevation (-)26 feet. The intake structure will be located approximately 300 feet west of the curtain wall. In going from the curtain wall to the intake structure, the sides of the channel converge from a width of approximately

560 feet to 385 feet, which is the width of the intake structure. The velocity of the water at the inlet to the intake structure will be about 1 foot per second.

B.1.4 Intake Structure

The intake structure as shown in Figures B.1-3 and B.1-4 will house a total of twenty-four (24) traveling screens, twelve (12) for each unit, each screen will be about 10 feet wide. The purpose of these screens is to prevent debris larger than one-quarter inch from passing into the circulating water pumps and condensers.

This structure also will house the twelve circulating water pumps, each of which is capable of pumping Bay water at the rate of 200,000 gallons per minute for condenser cooling purposes. Six (6) of these pumps are associated with each unit.

The structure also houses six (6) salt water pumps, three (3) of which are for each unit. Each pump will handle 15,500 gallons per minute of Bay water for the purpose described in Section B.1.2. Only two of these pumps are required to operate during normal operation of each unit.

The intake structure will be equipped with a chlorination system which will provide a means to inject chlorine into the cooling water entering the plant. The purpose of this system is to control slime and algae growth within the intake structure and in the cooling water piping between the intake structure and the condenser. The deep intake of cooling water, together with the Amertap system, which is discussed below, will preclude the need for the use of chlorine for fouling control in the condenser tubes. Chlorine or other biocides which will reach or affect the Waters of the State will not be used without the prior written approval of the Maryland Department of Water Resources. If approval is obtained, the chlorine or

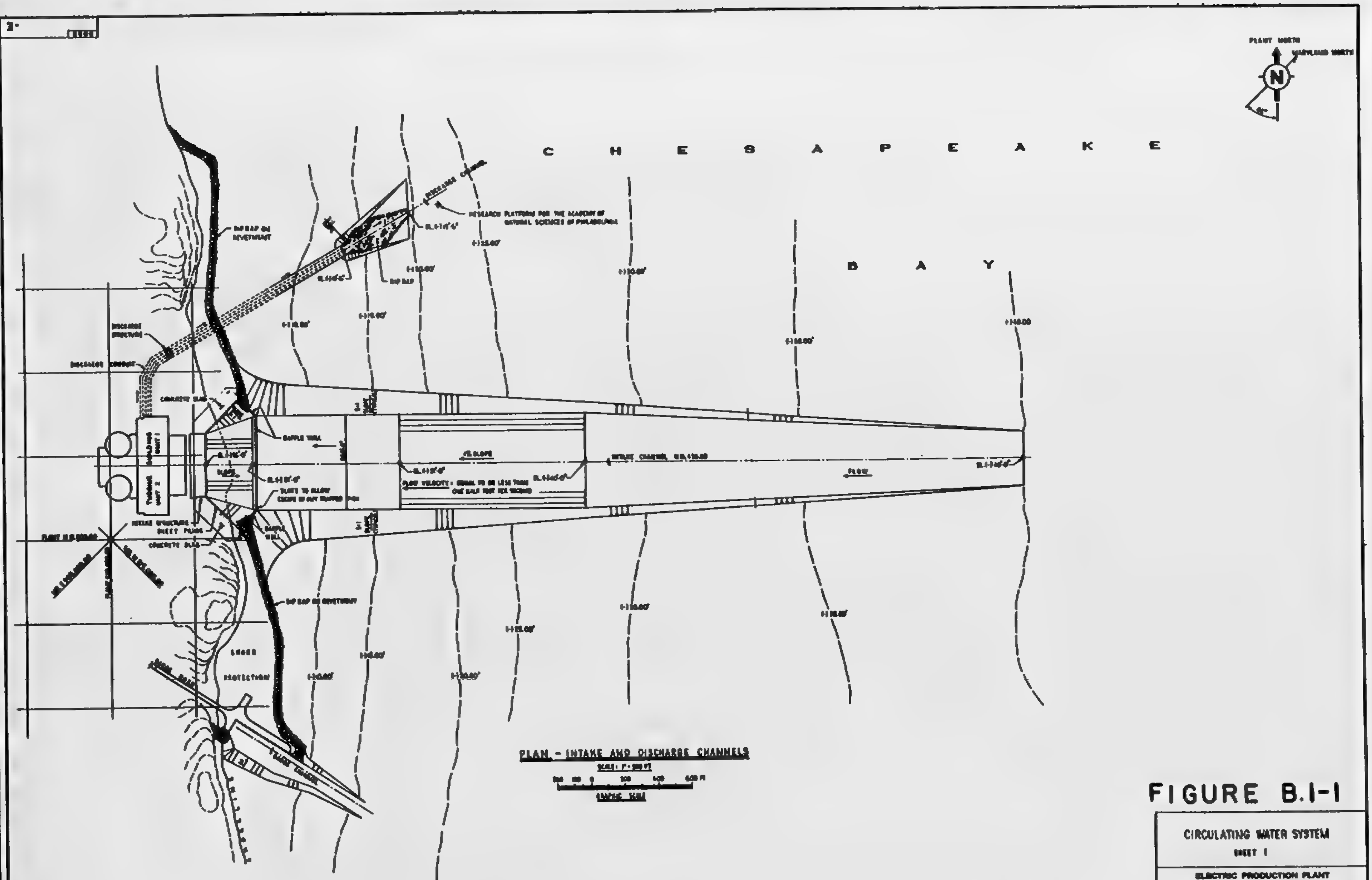


FIGURE B.1-1

CIRCULATING WATER SYSTEM

SHEET 1

ELECTRIC PRODUCTION PLANT

CALVERT CLIFFS UNITS I & II

BALTIMORE GAS AND ELECTRIC CO.

BECHTEL ASSOCIATES

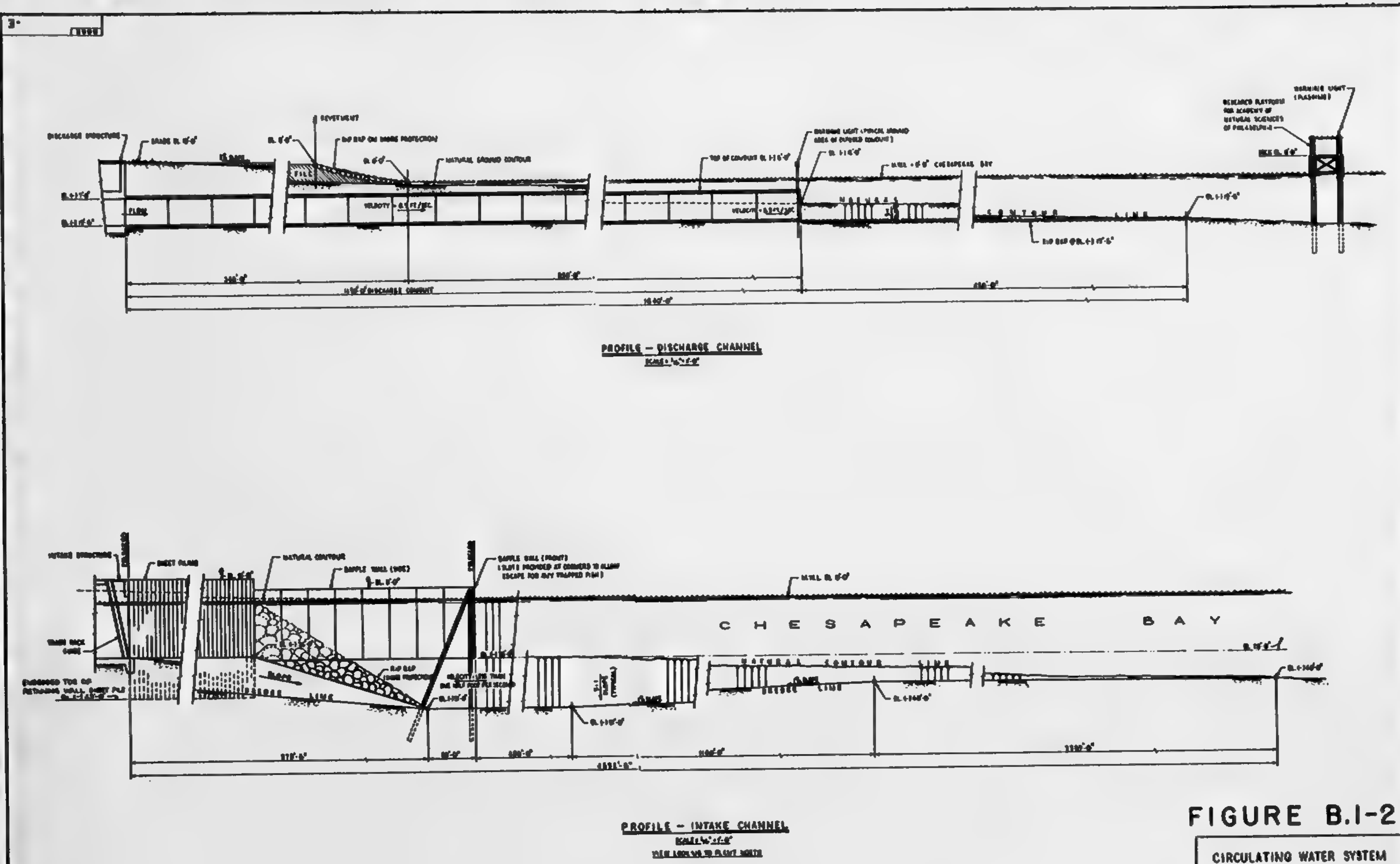


FIGURE B.1-2

CIRCULATING WATER SYSTEM
SHEET 2

ELECTRIC PRODUCTION PLANT
CALVERT CLIFFS UNITS 1 & 2
BALTIMORE GAS AND ELECTRIC CO.
BECHTEL ASSOCIATES

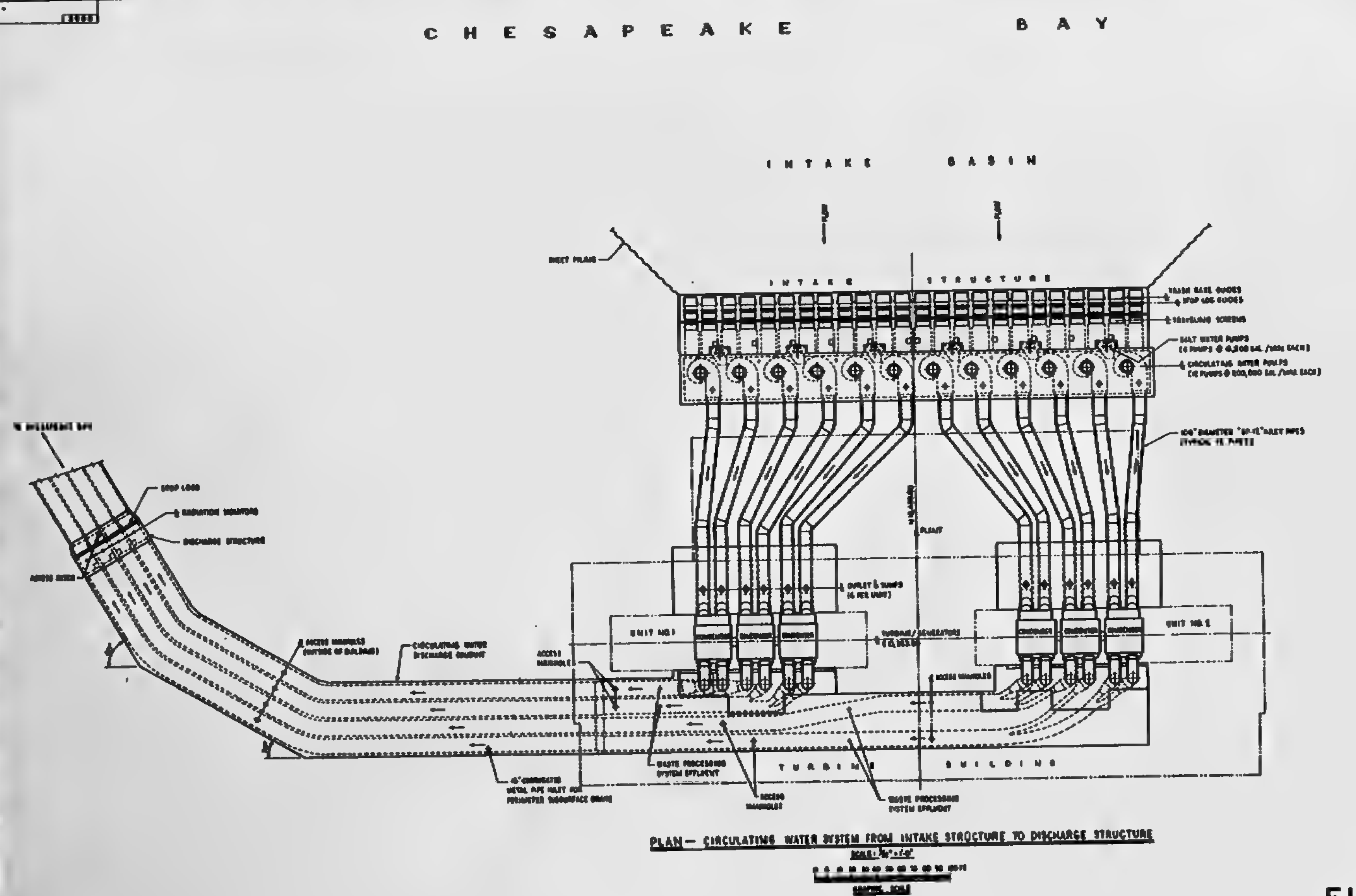


FIGURE B.1-3

CIRCULATING WATER SYSTEM

SHEET 3

ELECTRIC PRODUCTION PLANT

CALVERT CLIFFS UNITS 1 & 2

BALTIMORE GAS AND ELECTRIC CO.

BECHTEL ASSOCIATES

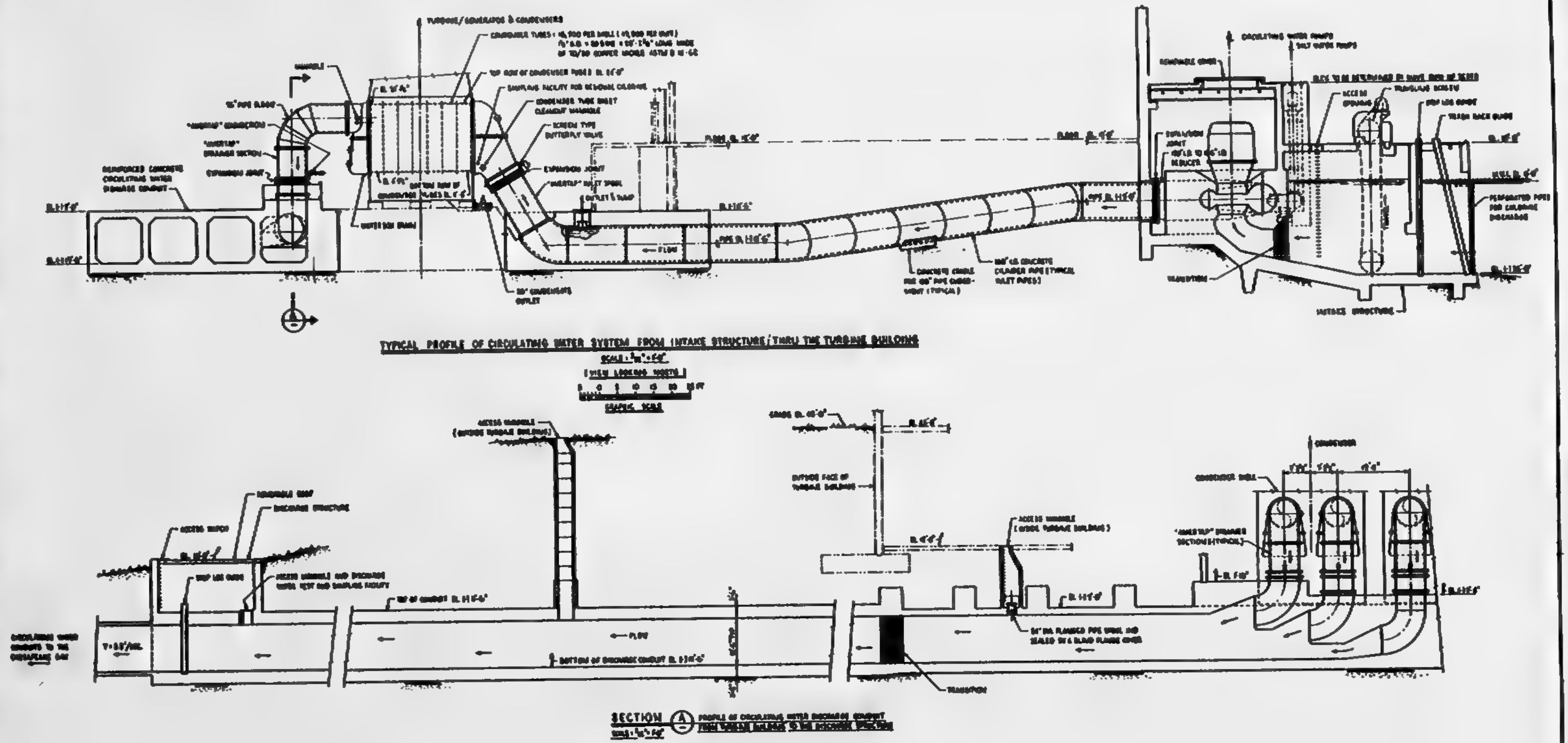


FIGURE B.1-4

CIRCULATING WATER SYSTEM
SHEET 4

ELECTRIC PRODUCTION PLANT

CALVERT CLIFFS UNITS 1 & 2

BALTIMORE GAS AND ELECTRIC CO.

BECHTEL ASSOCIATES

other biocide will be used only in accordance with the provisions of such approval.

B.1.5 Condenser

The condensers for each unit will consist of three (3) separate shells, each with the same capacity, to condense exhaust steam from the turbine. The cooling water side of the condensers will be of the single pass or once through design with divided water boxes so as to permit one-half of each shell to be opened and manually cleaned during plant operation, if necessary.

Each condenser will have approximately 49,000 tubes. These tubes will be 1-1/4 inches in diameter and approximately 28 feet long. The tube material will be 70-30 copper nickel. Operating experience at other plants indicates that little or no copper loss will be expected from tubes of this material.

As mentioned previously, each condenser will be equipped with a mechanical cleaning system to be furnished by the Amertap Corporation. This system utilizes small sponge rubber balls which are injected at the condenser inlet, passed through the tubes, collected at the condenser outlet, and returned for recycling.

A butterfly valve, equipped with a perforated disc instead of a solid disc, will be installed in each cooling water pipe at the inlet to the condenser water boxes. It will be possible to close this valve when its corresponding circulating water pump is shut down. Marine growth that may have been pumped against the condenser tube sheet should fall off and be caught by this strainer-type valve instead of falling further down and out of reach in the pipes. Conveniently located manhole doors can then be opened and the marine growth manually removed from the condenser.

B.1.6 Discharge Conduits

Upon leaving the condensers the cooling water passes through the discharge conduit and is thus returned to the Bay. This conduit will extend approximately 850 feet beyond the extended shoreline provided for shore protection. The top of this conduit will be at an elevation of (-)6 feet.

The velocity of the water through this conduit is approximately 8.9 feet per second. It will take approximately 3 minutes and 20 seconds for water leaving the condensers of No. 1 Unit to reach the end of the conduit and 3 minutes and 55 seconds for No. 2 Unit.

As shown in Figure B.1-3, the entire discharge structure is actually composed of four (4) separate conduits, two (2) for each unit. The effluent from the waste processing system can be discharged into any one or all of these four (4) separate conduits, thus providing a means to insure a maximum dilution of the effluent under all operating conditions.

A flow of at least 15,500 gpm will be maintained at all times in each and every discharge conduit. This is especially important during plant shut down, since standing water loses oxygen and a slug of toxic water could be created which could cause problems if rapidly pumped into the Bay.

B.2.0 RADIOACTIVE WASTE PROCESSING SYSTEMS

The waste processing system is designed to provide controlled handling and disposal of liquid, gaseous and solid radioactive wastes from both units in the Calvert Cliffs Nuclear Power Plant. Design criteria were established to minimize the release of radioactive material from the plant to the environment. The design performance for the liquid waste portion of the system was established by examining seafood consumption routes to determine limiting discharge concentrations. The system incorporates all of those components of proven reliability and performance which were commercially available for large power reactors at the time the equipment was purchased. There are other equipment components and system concepts for radioactive waste processing currently in the research and developmental stage. The progress of these efforts will continue to be evaluated.

B.2.1 Liquid Wastes

The primary source of liquid wastes is the reactor coolant. Reactor coolant is diverted to the waste processing system when changes in reactor coolant system water inventory are necessitated by startups, shutdowns, reductions in soluble boron content necessitated by fuel burnup, draining the reactor coolant system for maintenance, etc. The liquid from these sources is processed by the reactor coolant portion of the waste processing system.

In addition to the liquid waste coming directly from the reactor coolant system there are other miscellaneous sources of radioactive liquid waste. Some of these miscellaneous sources are the sampling systems, laboratory drains, auxiliary building floor drains and the blow down from

the steam generators. This liquid is processed by the miscellaneous portion of the liquid waste processing system.

Liquid waste is letdown from the primary coolant system through the chemical and volume control system to a filter which removes insoluble particles before it flows to the degasifier. The degasifier removes hydrogen and fission product gases from the liquid waste and discharges these gases to the waste gas surge tank. The degasified liquid is pumped through reactor coolant bleed ion exchangers, which remove soluble radioactive ions, then flows to the reactor coolant waste receiver tanks. From these tanks the liquid is pumped to one of two waste evaporators which distills the water and concentrates the boric acid. The concentrated boric acid is sampled at the evaporator for purity; then depending upon the results, is pumped either to the boric acid batching tank for reuse in the reactor coolant system or to the solid waste disposal system. The evaporator distillate is pumped to the reactor coolant waste monitor tanks for sampling. Piping is installed to permit multiple passes of the liquid through this entire system if necessary. When the activity level in the monitor tanks is acceptable for discharge, the liquid is pumped at a rate selectable over a range of 10-120 gpm to the circulating water system, where it is diluted with the condenser cooling water in the discharge conduits. Redundant radiation monitors and isolation valves are installed between the waste processing system and the circulating water system. These isolation valves will close automatically if the monitors sense high activity in the discharged liquid, thus preventing any further discharge.

The miscellaneous liquid waste is processed through equipment similar to that used to process the reactor coolant waste, with the exception of the evaporator, before being discharged. However, should the activity

levels in the miscellaneous waste require it, this liquid can also be processed through the reactor coolant processing system.

B.2.2 Gaseous Wastes

The radioactive gases, which are stripped from the liquid waste by the degasifier, are collected in the waste gas surge tank. This tank also receives gases collected from auxiliary building sources.

A waste gas compressor takes suction from the waste gas surge tank and discharges to one of three waste gas decay tanks where the gas will be stored at a maximum pressure of 150 psig. Sufficient tank capacity exists for storage of these gases for a 60 day period. When the activity level has decayed to an acceptable level, as indicated by analysis of a gas sample, the contents of the decay tanks are discharged at a controlled rate through the release header to the plant vents. The elevation of the plant vents is approximately 190 feet. The release header contains an absolute filter, redundant automatic isolation valves and a radiation monitor. The radiation monitor will automatically close the isolation valves upon sensing high radiation. Low activity vents and relief valve discharges are connected to the release header at a location ahead of the radiation monitor.

B.2.3 Solid Wastes

The solid waste disposal system provides the capability for preparing solid wastes for shipment to an approved off-site disposal facility. Spent radioactive ion exchange resin is pumped to a shielded spent resin metering tank where it is dewatered. The resin is then sluiced into a mixer which combines the resin with sand and cement and discharges the mixture to a suitable shipping container. Evaporator concentrate can be pumped directly to this mixer and blended with sand and cement for similar disposal. The above process is controlled from a remote panel which is shielded to protect the operator from radioactive exposure.

Radioactive filters are transported by remote handling equipment and trolleys from each filter housing to the waste disposal area and are loaded into the same shipping container that is used for spent resin and evaporator concentrate.

Low activity solid wastes such as contaminated clothing, rags and paper are compressed by a compactor located in the waste disposal area and stored in 55 gallon drums prior to off-site disposal.

B.2.4 Shipment of Radioactive Materials

All shipments of radioactive solid waste, including the shipment of irradiated fuel assemblies, will be in federally approved shipping containers and will be conducted in accordance with all AEC, DOT and other applicable regulations. The solid wastes will be shipped off-site for burial at an AEC licensed site. The irradiated fuel assemblies will be shipped off-site to an AEC licensed reprocessing plant.

B.3.0 OTHER EFFLUENTS

Associated with the power plant is a sanitary sewage treatment plant designed to operate at ninety-five percent (95%) efficiency. During approximately nine (9) months of a year, the effluent from this sewage treatment plant will be ten thousand (10,000) gallons per day (24 hours) and will be released into the circulating water discharge conduits. During the remaining three months, the effluent will be twenty thousand (20,000) gallons per day (24 hours). The solid content after mixing will be less than one (1) ppm.

Demineralizers will be installed in the secondary system to provide make-up water for plant services and to process condensate leaving the main unit condensers. These demineralizers will be regenerated using acid and caustic solutions. Following regeneration, these solutions will be pumped into a tank where they will be neutralized, sampled to determine that the proper pH was obtained, and then pumped into the cooling water discharge conduits for dilution and ultimate disposal in the Bay.

Filters will be installed in the secondary system following the condensate demineralizers. These filters will utilize a filter-aid material which is deposited on filter elements, and this material is removed along with the filtered solids by backwashing when the filters become dirty. The backwash water and the entrained solid material will be processed in a centrifuge which will remove 97 percent of the solids from the liquid effluent. The solids will be disposed of as a solid waste and the liquid, which will be essentially pure water, will be discharged into the cooling water discharge conduits.

APPENDIX C

DESCRIPTION OF ENVIRONMENTAL STUDIES

C.1.0 MARINE ENVIRONMENT STUDIES

C.1.1 Introduction

The Baltimore Gas and Electric Company retained the Academy of Natural Sciences of Philadelphia in November, 1967, to conduct a continuing research program designed to measure the effect of operations of the Calvert Cliffs Nuclear Power Plant upon water quality, biota and established water uses of the Chesapeake Bay.

The pre-operational study program will establish a base-line of the condition of aquatic life and the chemical, physical and bacteriological characteristics of the Chesapeake Bay in the vicinity of the plant site. This phase of the program will extend over a five-year period. Laboratory investigations will provide information for predicting effects on entrained organisms of environmental changes caused by plant operations.

In the operational phase of the program, the studies will be continued for five years from the date of the first appropriation and use of Chesapeake Bay water, or for a lesser period of time if the Department of Water Resources finds that the results of the studies warrant earlier termination of the research projects.

The ecological program is based on the hypothesis that every natural bay contains many organisms which form communities of species that interact in many ways with each other and the environment. Under conditions not adversely affected by pollution, the competition between species and the predator pressure is of such a magnitude that most species are represented by moderate to small populations, some of which are more common than others and only a few very common. Furthermore, the population sizes of particular species vary with season or in longer cycles.

C.1.2 Baseline Studies

General surveys of the aquatic conditions in the shallow water areas where most of the aquatic life is found are made each year during June and August. Since the relative diversity of species is of major importance, it is necessary to determine the species of all organisms which are established in the areas selected for study. In addition to the diversity of species, the kinds of species and their relative abundance and overall ecological relationships are studied. It has been found that those benthic organisms which move only relatively short distances give the most accurate indication of conditions in a body of water over a period of time. The plankton, the bacteria, and the chemical analyses give the condition only at the time of sampling. For these reasons, the collecting of the various species of plants and animals, particularly the shallow water forms, is an important part of the survey.

The areas of the Bay chosen for study include comparable ecological habitats which assure a given species equal opportunity to become established at all stations. The total area of a station is not as important a consideration as the inclusion of all types of habitats. Among the general ecological conditions considered in selecting stations are the structure of the bed, tides, contour and stability of bed, sedimentation, surrounding vegetation, type and amount of debris, and workability of the study area.

Float studies were made to determine the general areas in the vicinity of the plant site where the study areas should be located. Two outer stations, the ones most remote from the plant site, were chosen for the study of changes in aquatic conditions not caused by plant operation. Two inner stations were selected in areas which would have

the greatest exposure to the plant discharges.

On each survey, the field team consists of a protozoologist, an invertebrate zoologist, a phycologist, an ichthyologist, a water chemist and field assistants. The kinds of species, numbers of species, and their relative abundance are determined for each station. Also, chemical physical and bacteriological studies were made. These are made at high and low tide at least ten times at each station during each survey. From these data the mean standard deviation and standard error of the mean are calculated. The results of these various analyses are integrated and the general condition and health of the Bay in the four study areas determined.

In addition to the two intensive survey studies which are conducted annually, detailed investigations are made on a routine basis of the physical, chemical and bacteriological characteristics of the Bay waters, and on plankton, productivity, fish, crabs, oysters, clams, and other invertebrates.

Monthly analyses are made, weather permitting, for sulphates, phosphates, ammonia, total nitrogen, calcium, magnesium, sodium, potassium, manganese, boron, iron, chromium, nickel, lead, copper, cadmium, cobalt, strontium, zinc, alkalinity, hardness, pH, temperature, dissolved oxygen and carbon dioxide.

Bacteriological studies are made every other month to obtain a base for determining if the warm water discharges will have any significant effect on the bacterial population which, in turn, would affect the mineralization of the organic load and hence eutrophication, food organisms, and human uses.

Plankton studies, including both zooplankton and phytoplankton are conducted once each month unless the condition of the Bay makes this schedule impossible. Many of the larval forms of the more important food

organisms are found in the plankton, and the phytoplankton is a main food source of most important aquatic animals. Studies were added in 1970 to determine which organisms are most important in the various food chains which might be affected by plant operation. In these studies, gut analyses of the various organisms in the food chain of commercially important species are made. If it seems advisable, carbon-14 or other methods are used to identify the most important food organisms. Also, background radioactivity of organisms common in the area, as well as those that are important in the food chains leading to food utilized by humans, are measured.

An estimate of the size of the standing crop of phytoplankton is best made by productivity studies which consider not only fixed carbon but the kinds or species of phytoplankton fixing the carbon. These studies are made in the spring, late summer, and winter.

Studies were started in 1970 of the productivity in the area of the discharge and in areas completely out of the influence of the discharge. This is carried out by studying substrates and diatometers placed on research platforms. One platform will be located as near as possible to the point of discharge of the condenser cooling water. Because oysters will also be reared on the platforms, their locations have been determined with reference to water currents as well as to other factors.

The Bay is being fished in four areas, using commercial fisheries gear and methods. The kinds and weights of fish of each species are determined and their general condition noted. In addition to the commercial fishing carried out in the spring and fall, a special trawl study is carried out monthly to determine the quantities of fish in the plant area at depths of from 20 feet to 30 feet. A quarterly mid-water trawl program was initiated in 1970 to determine the fishes in the mid-water region (10 feet to 20 feet) at 15 randomly sampled stations. Also, a pound

net was added to determine the commercially important fish in the immediate plant area and to gain more data on the more important migratory commercial species, such as Rock, Blue, Drum and Cobia.

A fish tagging study using standard fluorescent dye techniques was undertaken in 1970 to determine the movements of fish in the vicinity of the plant. Particular emphasis is being placed on the movement of fish in and out of the area of the proposed cooling water discharge location. Also, a study was added on the migration pattern of crabs and small fish moving along the bottom of the estuary. This study will determine whether or not there are large numbers of these organisms in the vicinity of the plant site at all times during the year.

The size and number of crabs taken with a given amount of effort are determined by setting crab pots above, below, and in the general area of the plant site. The crab pots are serviced for five days each month during a seven-month period from May through November.

The oyster bars in this area are not regularly planted and therefore cannot be studied according to age class. A number of areas have been selected outside the area of influence of the plant and a number within the area of influence. These areas are being studied through the use of large sample statistical methods in the spring and fall. Also, trays containing three size classes of oysters will be suspended from the four research piers. One of these piers will be located so that it will be directly in the discharge plume of warmed water effluent from the plant. The oysters will be studied at least four times a year as to their growth, condition and associated organisms.

The distribution, and roughly the abundance, of clams in the area have been determined. The relative diversity of these populations in various areas is also being studied. A commercial clam dredge, supplemented by more detailed collections, is used twice a year to assemble

this data.

In order to assess the potential of fouling problems due to various invertebrates, substrates composed of different materials are being submerged at various depths and studied approximately four times a year. The organisms are identified as to species, and biomass produced in a given period of time is determined. In such manner, the seasonal variation in fouling organism growth at various depths is determined. These substrates will also provide an estimate of the invertebrates at various levels.

Analysis of sediments in selected areas was started in 1970 to determine the amount of various metals present prior to plant operation for comparison in the future with metals which might be associated with plant discharges.

C.1.2 Operational Studies

The program of baseline studies will be continued after plant operation begins to determine the effects, if any, on the aquatic environment of the Chesapeake Bay. Effects on biota will be evaluated through:

1. Comparison of the seasonal distribution and abundance of motile species (crabs and fish) within the heat plume and in adjacent (control) waters.

2. Comparison of the seasonal abundance of food supply organisms for major predator fish species (striped bass, white perch, bluefish, others in the heated plume and in adjacent (control) waters.)

3. Determination of the effects upon life history phases of plankton, nekton, and the benthos in the heat plume and in adjacent (control) waters, with special reference to migration and spawning.

4. Comparison of the seasonal distribution and abundance of plankton and nekton in the heat plume and in the adjacent (control) waters.

5. Determination of the effectiveness of screens, filters, egress ports or other devices to prevent entrapment of fish and crabs by the operations of the plant.

6. Enumeration of directly visible mortalities of fish and crabs, before and after plant operations in the predicted plume area and in the adjacent (control) waters by means of: (1) Aerial surveillance and aerial photos; (2) Shoreline counts; and (3) Boat counts.

7. Confirmation of predictions of model studies and evaluation of effects upon biota, by means of actual field testing during periods of time when intake water temperatures exceed 80 F and plant is operating at full load. As part of this study, the time-dependent areal extent of the heated water zone above 90 F will be determined.

In addition to determining effects of plant operation on biota, several hydrographic studies will be made to determine:

1. The extent and conditions under which previously heated water which has not returned to ambient temperature is recirculated.

2. The effect of operations upon the natural distribution of salinity and dissolved oxygen in the heated plume and in adjacent waters.

3. The velocity of the water at the intake screening and the velocities in the jet of the discharge.

4. The percentage of the net flow of Bay water past the plant which is used in the cooling system.

5. The dimensions, including shape, areal extent and vertical thickness of the thermal plume or separated parts in which temperatures greater than 1 F above normal temperatures occur.

C.1.3 Predictive Studies

The effects upon entrained organisms will be determined by laboratory studies which will simulate time-temperature and mechanical exposures of selected organisms subject to entrainment. The time-temperature

relationships will be selected from engineering predictions for in-plant transit. Following start of plant operation, the results of the laboratory studies will be checked by on-site determination of effects of entrainment on:

1. Passage without temperature elevation or use of biocides at ambient temperatures of approximately 32-87 F (mechanical effects only).

2. Passage under plant operating conditions of the predicted elevations of 9.6 F or resulting higher temperature elevations. The effects of passage shall be described for influent temperatures of approximately 32, 42, 52 (spring and fall), 62 (spring and fall), 72 (spring and fall), 82, and 85 F.

3. Passage with temperature elevation and each biocide or combination used at, (2) chronic low level; and (b) periodic high levels.

4. Seasonal mortalities in the food web.

5. Resulting plume population characteristics compared to control area.

Single, and multivariate laboratory studies will be made to define the responses caused by plant operations which may change the natural levels of temperature, dissolved oxygen, salinity, radionuclides including tritium, heavy metals and other chemicals including boron, biocides, cleaning, and other compounds which may be used in and discharged to the Chesapeake Bay. After the plant is placed in operation, the uptake and cycling of discharged heavy metals and radionuclides in selected organisms within the discharge plume will be determined through investigations of:

1. The biochemical and physiological effects, if any, in increases in rate of uptake or total concentrations.

2. Differences between concentrations in the zone affected by plant operations and an adjacent control area.

3. Biological and ecological effects of concentrations of metals and radionuclides upon selected organisms in the plume area.

4. The effect of these concentrations upon marketability and edibility of seafoods.

C.2.0 RADIOLOGICAL MONITORING PROGRAM

C.2.1 General

This surveillance program is designed to determine the magnitude of the radioactivity in the environment surrounding the nuclear reactor site, and to study fluctuations in the radioactivity levels. The data accumulated prior to plant start-up will serve as a guide and base-line from which any increase in radiation, due to plant operation or other causes, can be detected and evaluated.

The monitoring program utilizes 28 sampling stations (Figure C.2-1) selected on the basis of population density, meteorological, hydrologic and topographic features, as well as on considerations of the spatial distribution of projected plant effluents, including areas where concentrations of effluents in the environment are expected to be significant.

Media which first show changes in radioactivity are sampled most frequently. Those which are less affected by transient changes but show long-term accumulations are sampled less frequently.

The concentrations of radioactive discharges which determine the sampling frequency listed in Table C.2.1 are based on minimum detectable levels. Proper source control is the means of assuring environmental protection and the monitoring program is primarily a verification of the source control.

C.2.2 Pre-Operational Surveillance

A study of the environmental ambient radiation levels and an aquatic radiological monitoring program was initiated in the summer of 1970 and will be continued through plant start-up and operation. The preliminary background data are now being analyzed. The results and conclusions will be routinely submitted to the concerned State and Federal agencies.

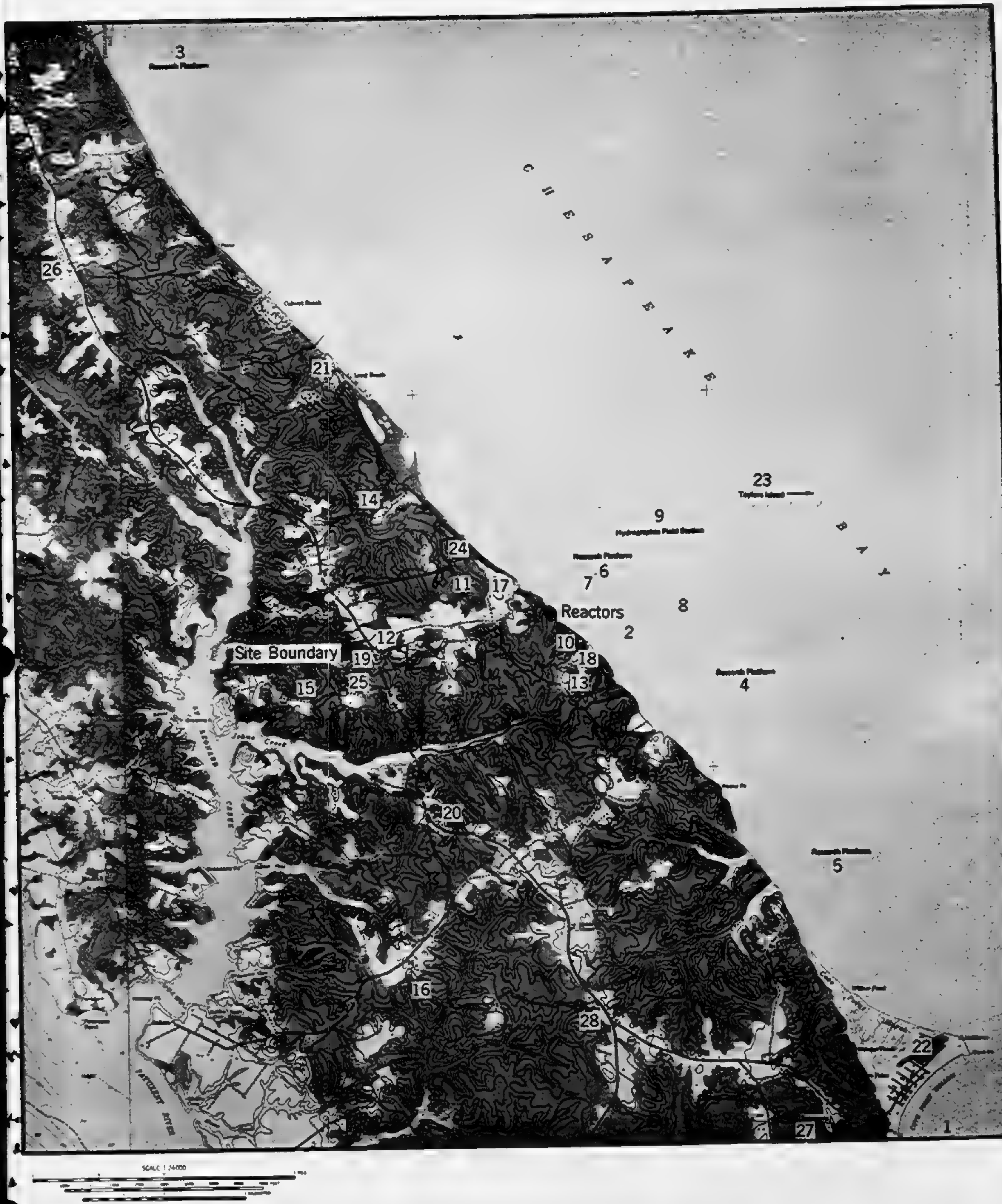


Figure C.2–1 ENVIRONMENTAL RADIATION SAMPLING STATIONS

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TABLE C.2.1

ENVIRONMENTAL RADIATION MONITORING FOR THE CALVERT CLIFFS NUCLEAR POWER PLANT

SAMPLING DESCRIPTION			SAMPLE FREQUENCY				ANALYSIS	REMARKS
pe of mple	Sample Point	Sampling Point Description	Pre-operational Program	Operational Program As a function of average waste discharges < 1/100 MPC	> 1/100 MPC	> 1/10 MPC		
sh (all ible species)	1	Pound nets south of Cove Point	QUARTERLY	QUARTERLY	QUARTERLY	MONTHLY	Flesh Gross beta K-40 Gamma spectrum Bone Sr-90	
	2	Pound net near plant intake						
ellfish ysters, abs, ams)	3 4 5	Research platforms of the Academy of Natural Sciences of Philadelphia	QUARTERLY	QUARTERLY	QUARTERLY	MONTHLY	Flesh Gross beta K-40, Gamma spectrum	The location of crab and clam samples may vary depending upon their availability at the specified location.
	6	(operational program only)						
ttom diments	7	In discharge canal near plant outfall	QUARTERLY	SEMI-ANNUALLY	QUARTERLY	MONTHLY	Gross beta K-40 Gamma spectrum	
	8	In intake canal near plant inlet						
rface ter	8 7 9	In intake canal Near plant outfall Hydrographic Field Station (June through September)	WEEKLY	QUARTERLY	MONTHLY	WEEKLY	Gross beta less K-40 Gamma spectrum Tritium Periodic gross alpha	

TABLE C.2.1

ENVIRONMENTAL RADIATION MONITORING FOR THE CALVERT CLIFFS NUCLEAR POWER PLANT

SAMPLING DESCRIPTION			SAMPLE FREQUENCY				ANALYSIS	REMARKS
...pe of ...mple	Sample Point	Sampling Point Description	Pre-operational Program	Operational Program As a function of average waste discharges <1/100 MPC	>1/100 MPC	>1/10 MPC		
...ound ...ter	10	On-site well	QUARTERLY	SEMI-ANNUALLY	QUARTERLY	MONTHLY	Gross beta (suspended and dissolved) Gamma spectrum Tritium Periodic gross alpha	
...il	11,12 13	Immediate site environs	QUARTERLY	SEMI-ANNUALLY	SEMI-ANNUALLY	QUARTERLY	Gross beta K-40 Gamma spectrum	Operational program samples will be stored for future analysis, if required.
...getation	14,15 16	On-site and from adjacent farms	QUARTERLY (or as available)	SEMI-ANNUALLY	SEMI-ANNUALLY	QUARTERLY	Gross beta K-40 Gamma spectrum	In addition to other vegetation, predominant food crops (corn and small grains) will be sampled at harvest time.
...r Particu-...ates Samples	17,18 19 20 21 22 23	Three on-site locations Lusby Long Beach Cove Point Taylors Island	WEEKLY	WEEKLY	WEEKLY	WEEKLY	Gross beta (after 72 hours decay period) Gamma spectrum	Gamma spectrum if gross beta activity exceeds 100 pCi/m^3.
...diation ...simeters (thermoluminescent dosimeters)	17,18 19,24	Four on-site locations	MONTHLY	MONTHLY	MONTHLY	MONTHLY	Beta and gamma radiation dose rate	Duplicate dosimeters will be placed at each sample point.

TABLE C.2.1

ENVIRONMENTAL RADIATION MONITORING FOR THE CALVERT CLIFFS NUCLEAR POWER PLANT

SAMPLING DESCRIPTION			SAMPLE FREQUENCY				ANALYSIS	REMARKS
pe of mple	Sample Point	Sampling Point Description	Pre-operational Program	Operational Program As a function of average waste discharges				
				< 1/100 MPC	> 1/100 MPC	> 1/10 MPC		
diation simeters on't)	20	Lusby	MONTHLY	MONTHLY	MONTHLY	MONTHLY	Beta and gamma radiation dose rate	
	21	Long Beach						
	22	Cove Point						
	23	Taylors Island						
	25	White Sands						
	9	Hydrographic Research Station						
	26	St. Leonard						
	27	Solomons						
	28	Bertha						

TE: Gross beta measurements, in general, will be used to screen samples for measurable activity in order to determine whether additional analyses are required. When the net beta count rate of a sample is different from the background count rate of the counting system by more than three times the standard deviation (3σ) in the background count rate, a gamma spectrum analysis will be performed.

The vectors which are routinely sampled include air, Bay water, ground water, soil and vegetation from the plant periphery, all edible species of marine organisms (including fish and shellfish) near the points of discharge. Ambient radiation levels are also being measured. Bottom sediments from the plant intake and discharge areas will be routinely sampled upon completion of the intake and discharge structures.

The sampling frequency and a summary of the description of the type of radiation analytical studies are listed in Table C.2.1.

The nearest dairy is located near Hollywood in St. Mary's County, at a distance of about 9 miles southwest of the plant, which processes milk from herds near Leonardtown, about 13 miles southwest of the reactor site. It is extremely unlikely that any release from the plant would be detectable that far from the plant. Consequently, iodine in milk is not included as a routine sample. However, some analyses are in progress as a matter of interest on random milk samples originating from that dairy.

C.2.3 Operational Surveillance

The operational program is presently planned to be identical in scope, with respect to the number of locations of samples, to the pre-operational program. The sampling frequency and scope of analyses, however, will vary with the concentration of radioactive plant effluents. That is, if the activity discharged from the plant increases, not only will the sampling rate of the environmental media be increased, but the scope of analyses will also increase. Thus at low discharge concentrations, analyses will be generally limited to gross activity measurements. At higher concentrations, gamma spectra analyses will be performed, along with the determination of specific nuclides as and when necessary. These analyses will include H-3, Sr-90, Cs-137, I-131 and others as appropriate.

Fish and shellfish samples will be analyzed for gross radioactivity and the controlling radionuclides, as required. The program will be periodically reviewed, however, to assure that radioactive discharges from the plant are within acceptable limits for environmental radiation exposure.

C.2.4 Interpretation of Radioecological Data

It is known that marine organisms have the ability, alone or by means of their aquatic food, to concentrate certain stable elements and radionuclides above the ambient concentrations in a saline water environment. Consequently, it is anticipated that the critical pathway for radiation exposure will be through human consumption of edible species harvested from the Bay waters in the immediate vicinity of the discharges from the plant.

In order to estimate the potential dose received by an individual from ingestion of seafood containing trace amounts of radionuclides, data on "reconcentration factors" -- i.e., the ratio of the concentration of a specific radionuclide in a given seafood to that in its ambient water, must be known with a reasonable degree of certainty. Such data, however, are not only limited but also there occur apparently some noticeable discrepancies in the values reported in the literature. Consequently, a program is under way to obtain reliable data on "reconcentration factors" for tritium, iodine, chromium, cobalt and others. These values will be compared to published values, and will be used, together with the computational methods of the International Commission on Radiation Protection, in our final calculations of estimates for annual whole body dose received by an individual to assure compliance within the specified Atomic Energy Commission limits.

APPENDIX D

POSSIBLE EFFECTS OF ACCIDENTAL RELEASES

All credible accidents in the plant, including the maximum hypothetical accident, have been analyzed. The consequences of these accidents and the resulting off-site radiation doses are listed in the Calvert Cliffs Preliminary Safety Analysis Report. This report was filed with the AEC on January 25, 1968 (Docket Nos. 50-317 and 50-318) and subsequently amended by Amendments 1 through 10. All accidental doses are within the guidelines established by the AEC's regulation 10 CFR 100.

APPENDIX E

PERMITS REQUIRED FROM LOCAL, STATE, AND FEDERAL AGENCIES

Local, State, and Federal agencies from which licenses, permits or other approvals must be obtained before construction and operation of the facility may begin are as follows:

E.1.0 CALVERT COUNTY REGULATORY AGENCIES

1. County Commissioners of Calvert County Rezoned from agricultural to commercial to permit the property to be used for an electric generating plant. Case No. 66-510 dated June 14, 1966.
2. Department of Inspection and Permits issued building permit for construction of warehouse August 16, 1968.
3. Department of Inspection and Permits issued building permit for construction of power plant February 17, 1969.
4. Calvert County Health Department:
   Sewage disposal system for construction facilities approved February 14, 1969. Approval of sewage disposal system from power plant pending approval of final design.

E.2.0 STATE REGULATORY AGENCIES

1. Department of Water Resources:

   a. Surface Water Appropriation Permit No. C-70-SAP-1 dated July 15, 1970, authorized use of Chesapeake Bay water for cooling purposes.

   b. Waterway Construction Permit No. C-70-CI-12 dated July 15, 1970, authorizes dredging of intake and discharge channels and the construction of related offshore structures.

   c. Certification from State of Maryland Department of Water Resources, dated 17 September 1970, on dredging operation and plant effluent to be discharged into the Chesapeake Bay from Calvert Cliffs Nuclear Power Plant, pursuant to provisions of Section 21 (b)(1) of Public Law 91-224 of the Water Quality Improvement Act of 1970.

   d. Ground Water Appropriation Permit No. CA-69-GAP-010 dated July 21, 1969, authorized Company to appropriate and use ground water of an average of 600,000 gallons per day and not to exceed a maximum of 865,000 gallons in any one day.

   e. Channel Improvement Permit No. C-69-CI-4 dated January 16, 1967, authorized installation of 3700 feet of rip-rap shore protection.

   f. Channel Improvement Permit No. C-69-CI-6 dated January 16, 1967, authorized construction of barge unloading dock and dredging of a channel

from deep water into this dock for the purpose of unloading barges.

2. State Roads Commission of Maryland:

   a. Permit No. A-C-3894-68 dated July 17, 1968 - permission to construct a commercial entrance road into the Calvert Cliffs Nuclear Power Plant.

3. Department of Health:

   1. Authorization for disposal of construction building sewage dated February 17, 1969, permit No. 69-25-0162. Plan for disposal of sewage from power plant has been approved. Permit will be granted at a later date.

   2. Certification of vents from containment structures and auxiliary building has not yet been applied for.

   3. Registration of installation of heating boiler and diesel generators for plant authorized by permit Nos. 0470400014 and 0470400018 dated April 21, 1970.

   4. Maryland Public Service Commission:

      a. On November 2, 1970, the Company filed Application for a Certificate of Public Convenience and Necessity for the construction of the power plant. The Application was filed shortly after the Maryland Court of Appeals ruled that a Certificate of Public Convenience and Necessity for the power plant was necessary. A public

hearing on this Application will begin on November 25, 1970, in Prince Frederick, Maryland.

b. Application for a Certificate of Public Convenience and Necessity for the construction of two 500 kv transmission lines from Calvert Cliffs Nuclear Power Plant to Waugh Chapel Substation was filed on April 3, 1969. Following a lengthy hearing, the Commission granted the Certificate on April 17, 1970; which was modified on April 22, 1970, by the addition of two conditions. The Commission reaffirmed its decision on August 12, 1970, after a rehearing on a portion of the transmission line route.

E.3.0 <u>FEDERAL REGULATORY AGENCIES</u>

1. United States Atomic Energy Commission:

   a. Variance approved by AEC on January 10, 1969, granting permission for construction of certain work in the nuclear portion of the plant.

   b. Provisional Construction Permit No. CPPR-63 - Unit No. 1 and CPPR-64 - Unit No. 2 issued by the United States Atomic Energy Commission on July 7, 1969, authorized construction of nuclear facilities of the Project.

   c. Supporting data for operating license application for the Project will be submitted early in 1971 to the United States Atomic Energy Commission.

   d. Personnel required to operate the units described in the Project are in the process of being trained to obtain the necessary license from the Operating Licensing Branch of the United States Atomic Energy Commission.

2. Department of the Army, Baltimore District - Corps of Engineers:

   a. Permission obtained for construction of barge unloading dock granted January 22, 1969.

   b. Permission obtained for dredging of channel in connection with installation of barge unloading dock granted January 22, 1969.

   c. Permission obtained for installation of offshore

research platforms for marine ecology studies granted May 27, 1969 - Permit No. NABOP-P (Baltimore Gas & Electric Company) 119.

d. Application has been made for dredging required for intake and discharge canals and the construction of related offshore facilities.

e. Installation of 3700 feet of rip-rap shore protection granted January 22, 1969 - Permit No. NABOP-P (Baltimore Gas & Electric Company) 112.

3. Department of Transportation - United States Coast Guard:

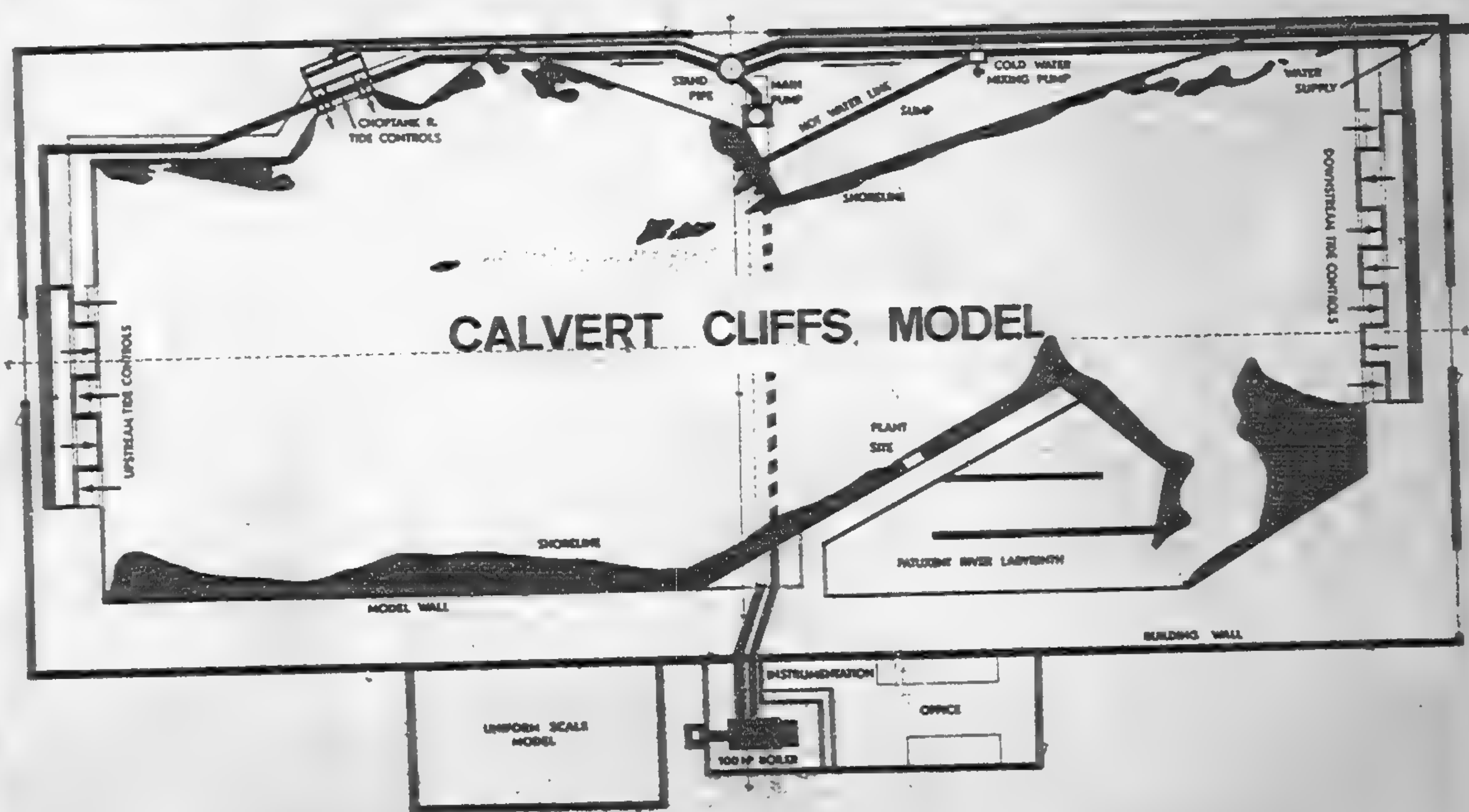
a. Aids to navigation for:

1. Offshore research platforms authorized by approved form CG-2554 dated June 25, 1969.

2. Barge unloading dock and shore protection authorized by approved form CG-2554 dated March 26, 1969.

3. Submerged pipe presently in work.

ALDEN RESEARCH LABORATORIES



WORCESTER POLYTECHNIC INSTITUTE
MDCCCLXV

SUMMARY REPORT
of
CALVERT CLIFFS MODEL STUDIES
for
BALTIMORE GAS AND ELECTRIC COMPANY

December, 1969

BEST COPY AVAILABLE

SUMMARY REPORT

of

CALVERT CLIFFS MODEL STUDIES

for

BALTIMORE GAS AND ELECTRIC COMPANY

Prepared by

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at

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Lawrence C. Neale, Director

December, 1969

ABSTRACT

A scale model of a section of the Chesapeake Bay, including the proposed Calvert Cliffs Power Plant, was constructed at the Alden Research Laboratories, Holden, Massachusetts for the Baltimore Gas and Electric Company.

The purpose of the model was to study the discharge of heated condenser water from the plant at the Calvert Cliffs site.

Model adjustment and testing have produced model data that will allow a determination of temperature increase in the Chesapeake Bay due to plant operations considering a variety of intake and discharge configurations, condenser water flows, tidal and salinity conditions.

The proposed plant configuration and plant operating conditions are presented and model data covering this combination are presented.

INTRODUCTION

A scale model of a 34-mile long portion of the Chesapeake Bay has been constructed at the Alden Research Laboratories for the Baltimore Gas and Electric Company. The model reproduces the Chesapeake Bay from below the influx of the Patuxent River (from Bluff Point on the west to Pill Hill Run on the east) to the north end section from Fishing Cove Creek to Tilghman's Island.

The model scales are 1/1000 horizontally and 1/100 vertically thus producing a model distortion of 1/10. The model is designed to reproduce automatically the tidal variations. The model scaling has been based on the Froude Law. The Froude Number is the ratio of gravitational forces to inertia forces and is expressed $\frac{V}{\sqrt{gD}}$

where

V = velocity

g = gravitational acceleration

D = depth of water

The Froude Number must be the same for both model and prototype. The resulting scale ratios are tabulated below.

Quantity	Physical Relationship	Conversion Ratio
Length L	Horizontal Distance	1:1000
Depth H	Vertical Distance	1:100
Area A	$A = LH$	1:100,000
Volume Vol	$Vol = L^2H$	1:100,000,000
Velocity V	$V = \sqrt{2gH}$	1:10
Time T	$T = L/V$	1:100
Q	$Q = AV$	1:1,000,000

Complicating the hydraulic characteristics of the modeled section of the Chesapeake Bay is the tidal nature of the flow. Water surface elevations and tidal flows at the bay cross sections corresponding to the model limits vary cyclically with time. In order to properly represent these fluctuations all model flows are instrumented to vary with time. The prototype tide cycle (12.5 hrs.) is therefore modeled in accordance with the time ratio given above, the model tide cycle having a period of 7.5 minutes.

Density similarity between the model and the prototype, including the power plant intake and discharge, is developed by holding all model water temperatures equal to the corresponding prototype water temperatures. The density effects are properly represented as a result of the one-to-one temperature ratio.

Since the model studies must provide a valid assessment of heat transfer phenomena as well as mass transfer phenomena careful consideration must be made of all forms of heat transfer. Solar and wind effects are essentially eliminated by enclosing the entire model in a building. Evaporative effects are minimized and controlled by maintaining the model environment at a relative humidity in excess of 90%. Convective heat transfer at the water-air interface is minimized by maintaining the model air temperature within about one degree fahrenheit of the base water temperature. Model test data is therefore affected only by convective heat transfer from the heated plant discharge to the air.

The model, as described above, is specifically designed for heated water work and to provide data on the main bay and its performance. It is also desirable and necessary to study the detailed performance of the plant intake and discharge structure.

Therefore, a smaller model of undistorted scale (1/50) has been constructed adjacent to the main model to include the local area within a radius of 1000 feet from the plant site. This uniform scale model allows the discharge jet flow patterns and related intake and discharge flows to be studied. Additional uniform scale models with scales of 1/100 and 1/250 were constructed to study in detail various project structures and related phenomena.

CONSTRUCTION OF THE MODEL

The Calvert Cliffs Model Building, measuring 204 feet by 90 feet was constructed on a site adjacent to an existing water supply at the Alden Research Laboratories. (See Figures 1 and 2.)

The main model building, consisting of a steel frame with plywood sheathing, has an attached addition measuring 16 feet by 48 feet. This additional space is utilized for instrumentation, a boiler and an office area.

The floor of the building is a 5" reinforced concrete slab poured on grade. The overhead clearance is 14 feet from finish floor to the bottom chord of the roof trusses. A section of the floor has been recessed 4 feet below the level of the main floor in order to form a reservoir or sump for water storage.

Construction of the scale model of the section of Chesapeake Bay, which occupies approximately three-quarters of the building floor area, began with the erection of concrete walls forming the model outline. The concrete walls formed, with the floor, a water-tight basin for construction of the three dimensional model topography.

Topographical data taken from United States Coast and Geodetic Survey Maps was transferred to wooden templates in the carpenter shop. The wooden templates were then placed in the model basin according to the coordinate grid system, (Fig. 3). The elevation control for the templates is maintained with an engineer's level. A mixture of gravel and sand was compacted in the model basin to within 1 inch of the top edge of the wooden templates. A coating of concrete molded to the bottom topography and using the top edge of the templates as a guide completed the model topography. (See Figure 4.)

Figure 1 Model Building Exterior

Figure 2 Completed Model

Figure 3 Forming Model Topography

Figure 4 Coating of Model

Additional detail was incorporated in molding the underwater topography near the Calvert Cliffs Plant Site. In this area more detailed topographic data and closer template spacing were employed. (See Figures 5 and 6.)

The model of the Chesapeake Bay includes four cross sections through which significant volumes of water pass into and out of the modeled area. These 4 sections are: the downstream model limit on the main Chesapeake Bay, the upstream model limit on the main Chesapeake Bay; the Choptank River; the Patuxent River.

The Patuxent River has been represented as a labyrinth. This labyrinth, constructed in the same manner as the model bay topography, is essentially the effective Patuxent River tidal volume and length, fitted into the available floor space. The shape and cross section of the labyrinth have been designed such that the tidal storage characteristics, including both volume and phase, of the Patuxent River are correctly reproduced.

The flows into and out of the model at the downstream model limit, the upstream model limit and the Choptank River are handled by tide flow controls. At these three sections mechanisms have been designed to produce the required flow into or out of the model.

This is accomplished by two independent mechanisms at each section, one mechanism regulating flow into the model and the other mechanism regulating the flow out of the model. (See Figures 7 and 8.)

The mechanisms controlling the flow into the model consist of concrete weir boxes with calibrated sharp-edged, steel weirs. All three of the weir boxes are supplied by pipe lines from one standpipe operated under constant head. The

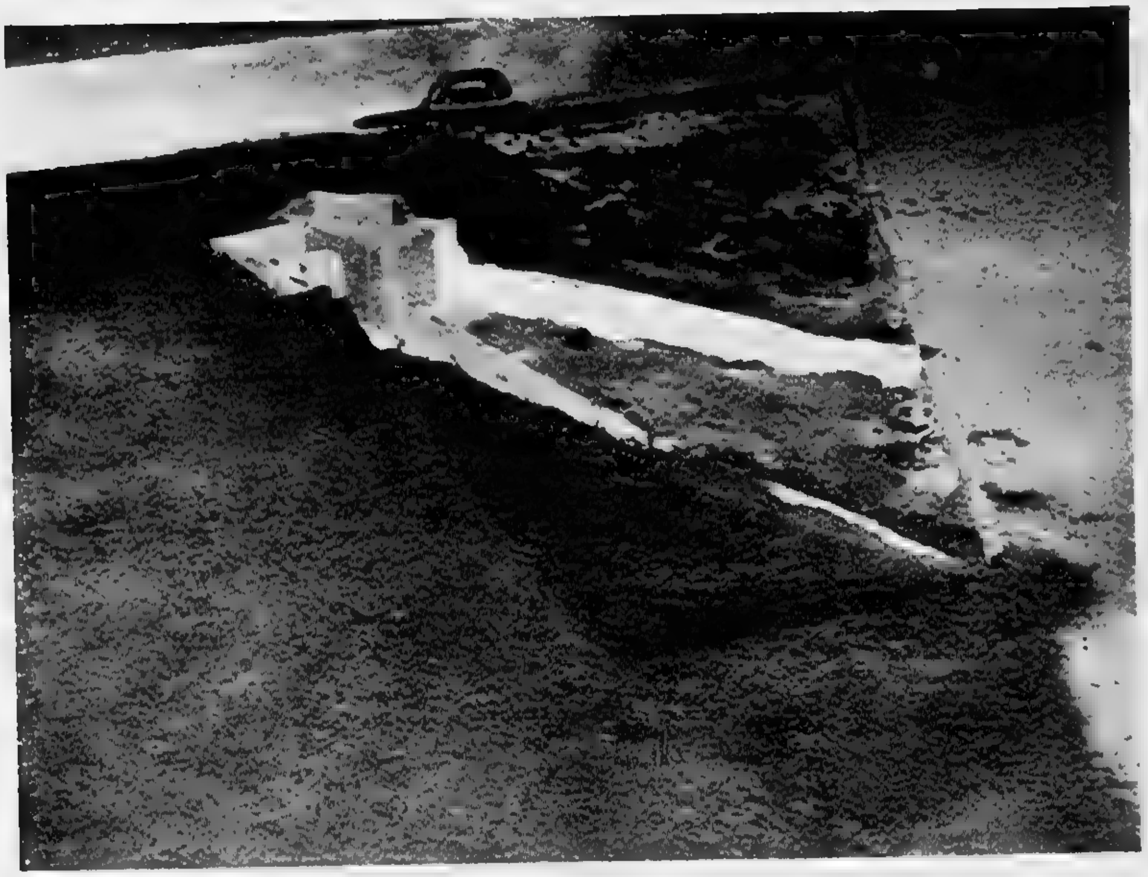


Figure 5 Construction of Plant Structure

Figure 6 Plant Structure Completed

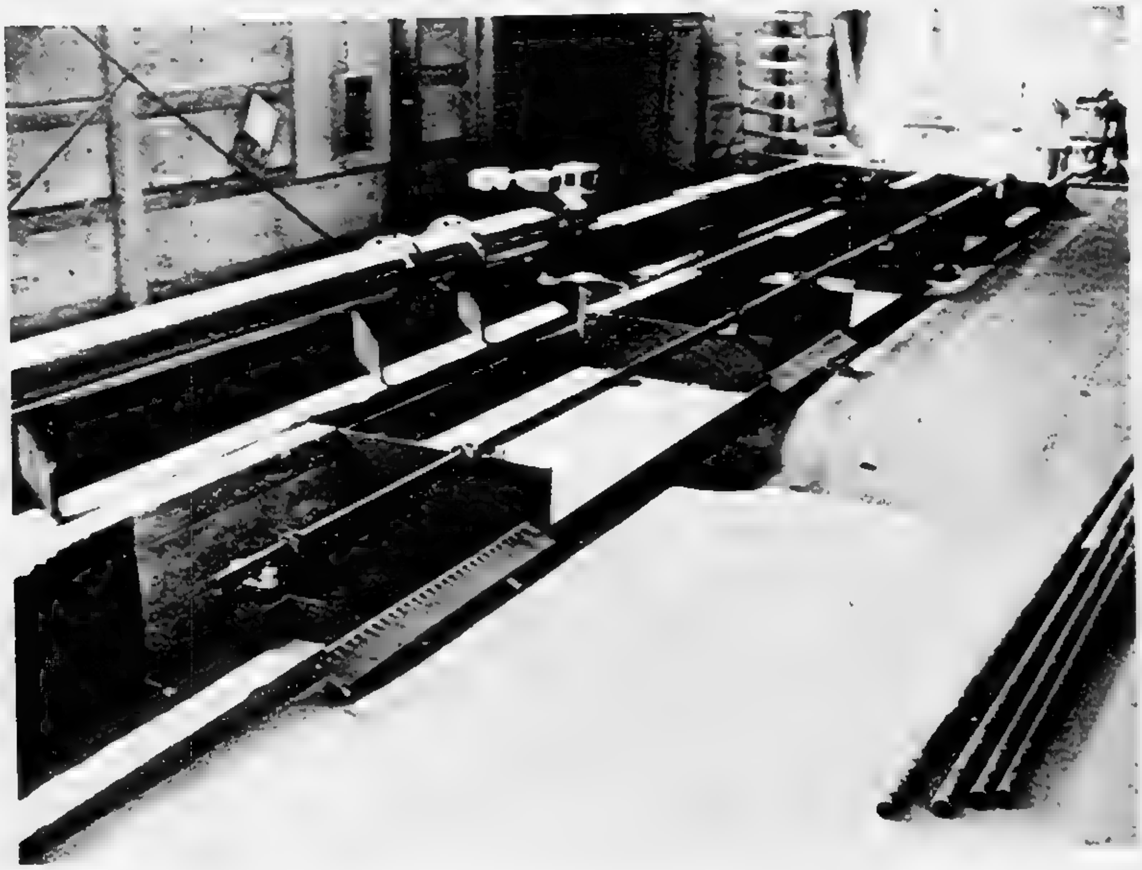


Figure 7 Downstream Model Limit

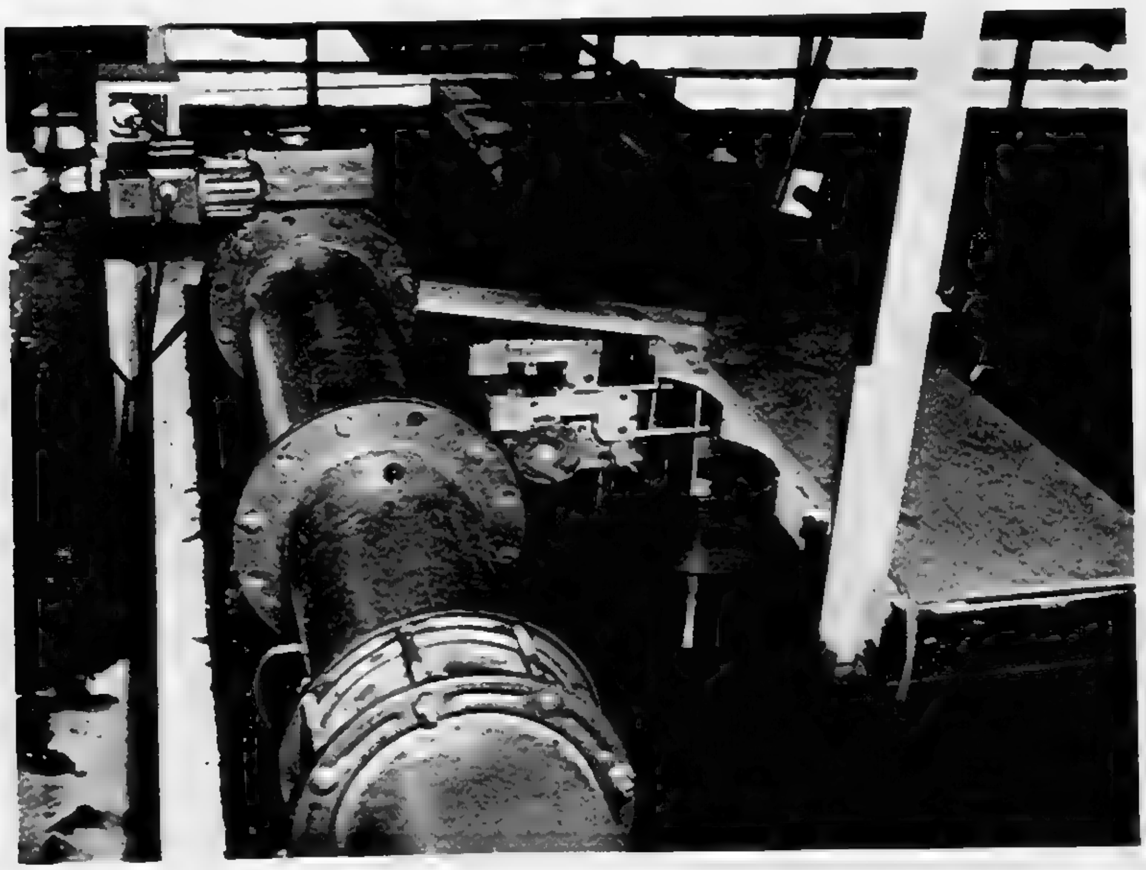


Figure 8 Downstream Tidal Controls

standpipe is supplied by a 15-horsepower pump, drawing water from the sump.

Motorized butterfly valves in the pipe lines leading to the weir boxes throttle the flow into the model. Each motorized valve opens or closes on a signal from a float-cam device monitoring the water surface in the respective weir box. The float of the float-cam device is the center of a feedback system which measures the flow entering the model, compares this with the desired flow, and signals any necessary valve adjustment.

In each pipeline supplying the weir boxes an appropriately sized orifice has been installed and connected to a water-air differential manometer. This equipment allows accurate measurement of flow entering the model at any time.

The mechanisms which regulate the flows out of the model at the downstream model limit, the upstream model limit and the Choptank River are movable steel weirs actuated by float-cam devices. Each set of movable weirs will raise or lower as indicated by a signal from the respective float-cam device. The float drives the feedback loop which, in this case, measures the water surface elevation, and signals any necessary weir movement to maintain the required water surface elevation.

All flows leaving the model pass through concrete flumes back to the model reservoir. The reservoir is initially filled from the external water supply. A 25-horsepower pump located at the external water supply can be utilized not only to fill the model reservoir but also to supply the weir boxes directly. This additional piping will allow model dye studies without a build-up of dye by wasting the water after leaving the model.

In order to model water temperatures for both the Chesapeake Bay and the power plant discharge a 100-horsepower oil-fired boiler has been installed as a water heater. The boiler, with its associated piping, is capable of warming the model bay water and the power plant discharge water to any anticipated prototype temperatures.

For the purpose of recording bay temperatures, environmental temperatures and plant intake and discharge temperatures 144 copper-constanan thermocouples have been strategically located on the model. The thermocouples are connected to six, 24 channel multi-point potentiometric Esterline Angus recorders by polyvinyl chloride insulated, premium grade thermocouple wire.

The thermocouple wires lead from the probes located on the model to the recorders situated on an instrument bench in the office. From each probe the thermocouple wire was brought vertically up to the supporting steel of the building. The wires were then led into the instrument area at this level. (See Figures 9, 10, 11.)

Model air temperatures and relative humidities are measured with mercury dry bulb and wet bulb thermometers at various stations around the model. Additional, and portable, temperature measuring capability is provided by 23 thermistor probes and a Yellow Springs Instrument Company Thermistor-Thermometer. (See Figure 12.)

Field data indicates that the water surface elevation in the model bay should vary a maximum of 0.02 feet during a normal tidal cycle. This small fluctuation is accurately recorded by a device consisting of a float attached to a cantilever beam. Deflection of the beam caused by float movement is transmitted from strain gages mounted on the beam to a single channel Sanborne recorder. The recorder output consists of a plot of water surface elevation versus time, (Figure 13.)

Figure 9 Thermocouples Installed

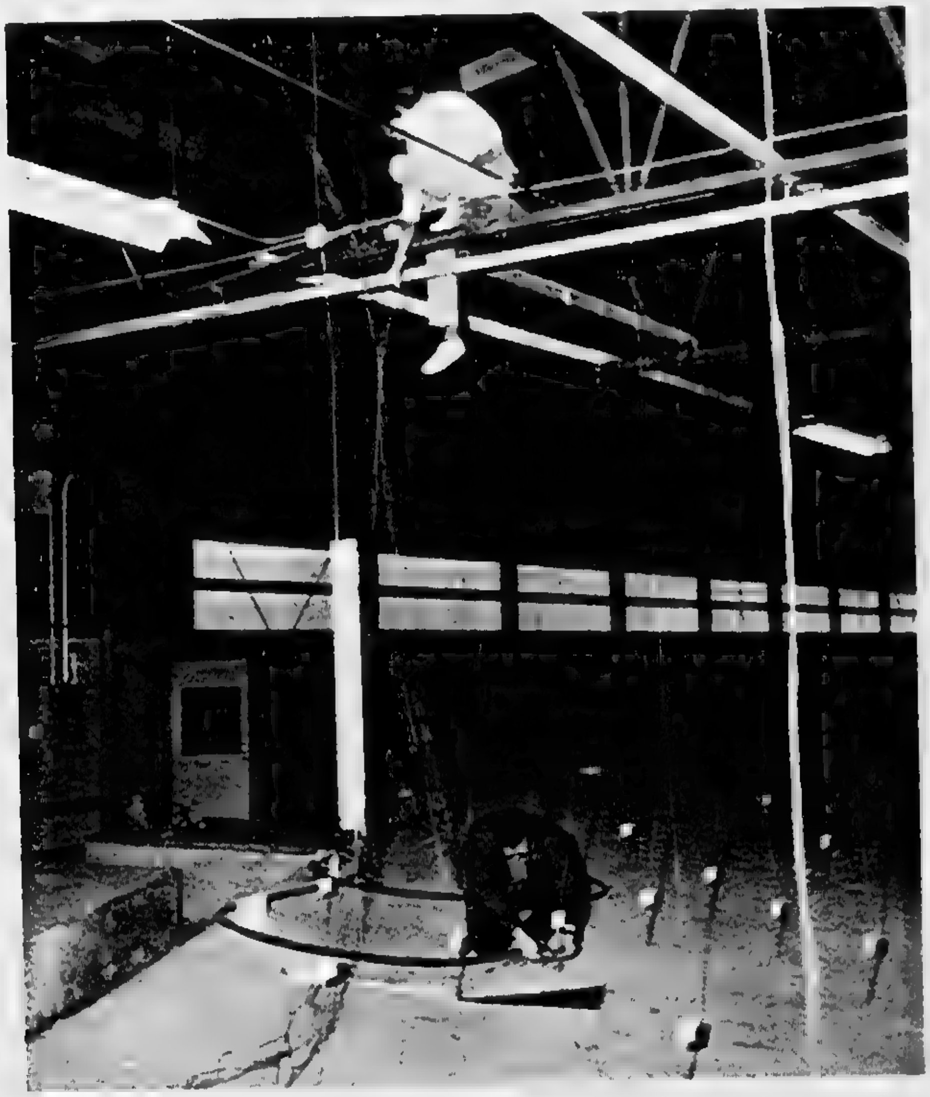


Figure 10 Thermocouple Wire Installation

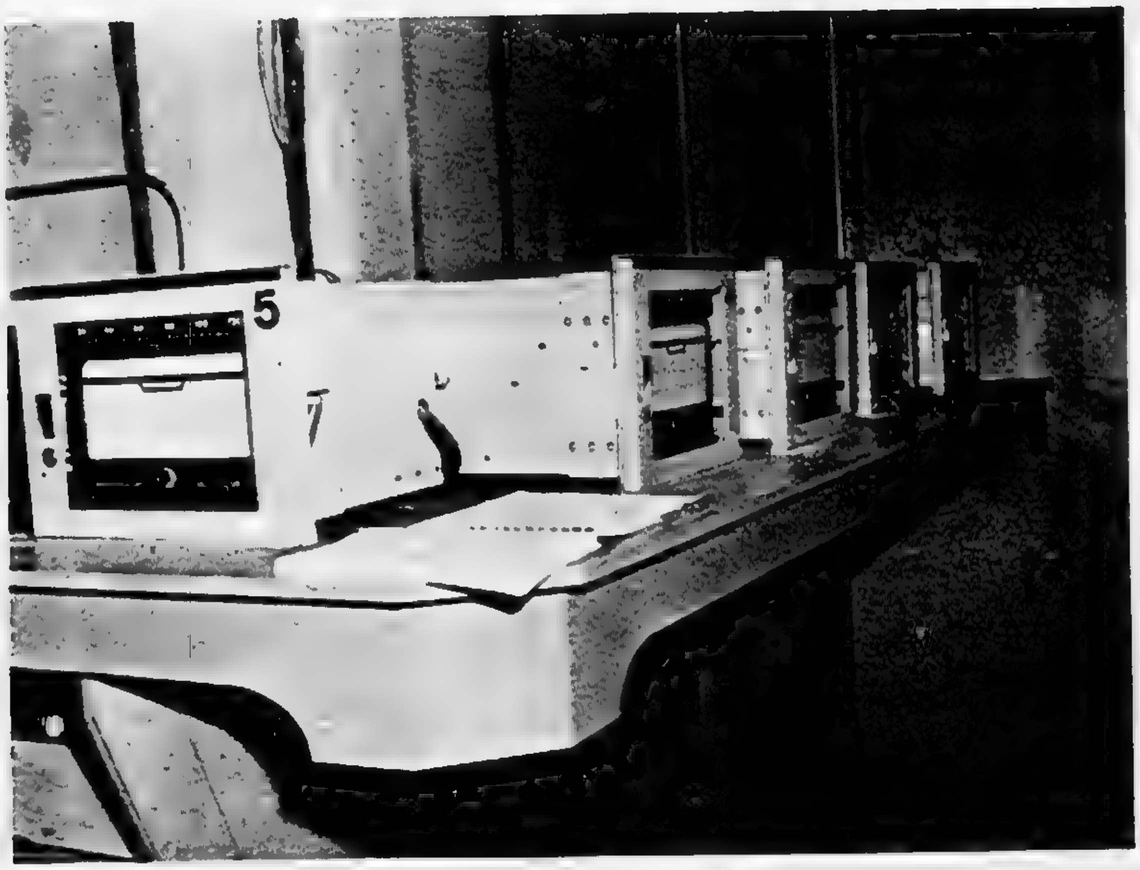


Figure 11 Temperature Recorders

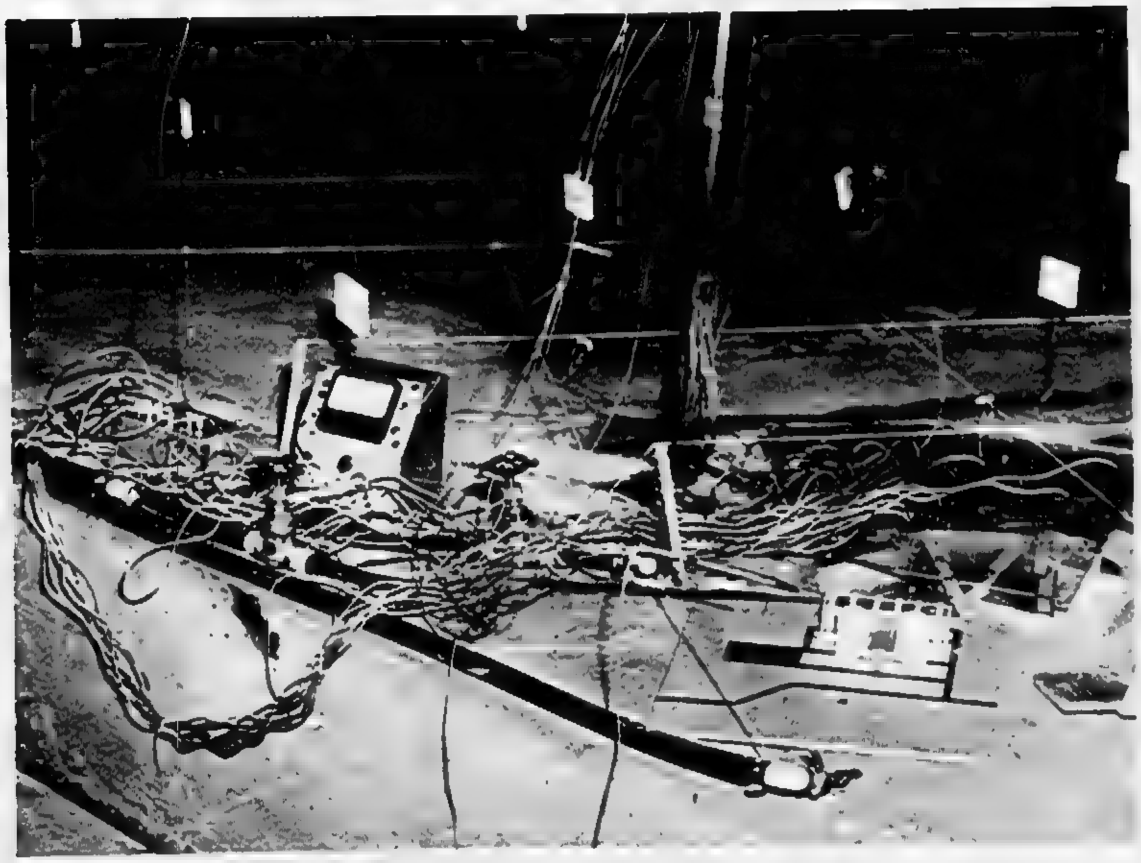


Figure 12 Thermistor – Thermometer

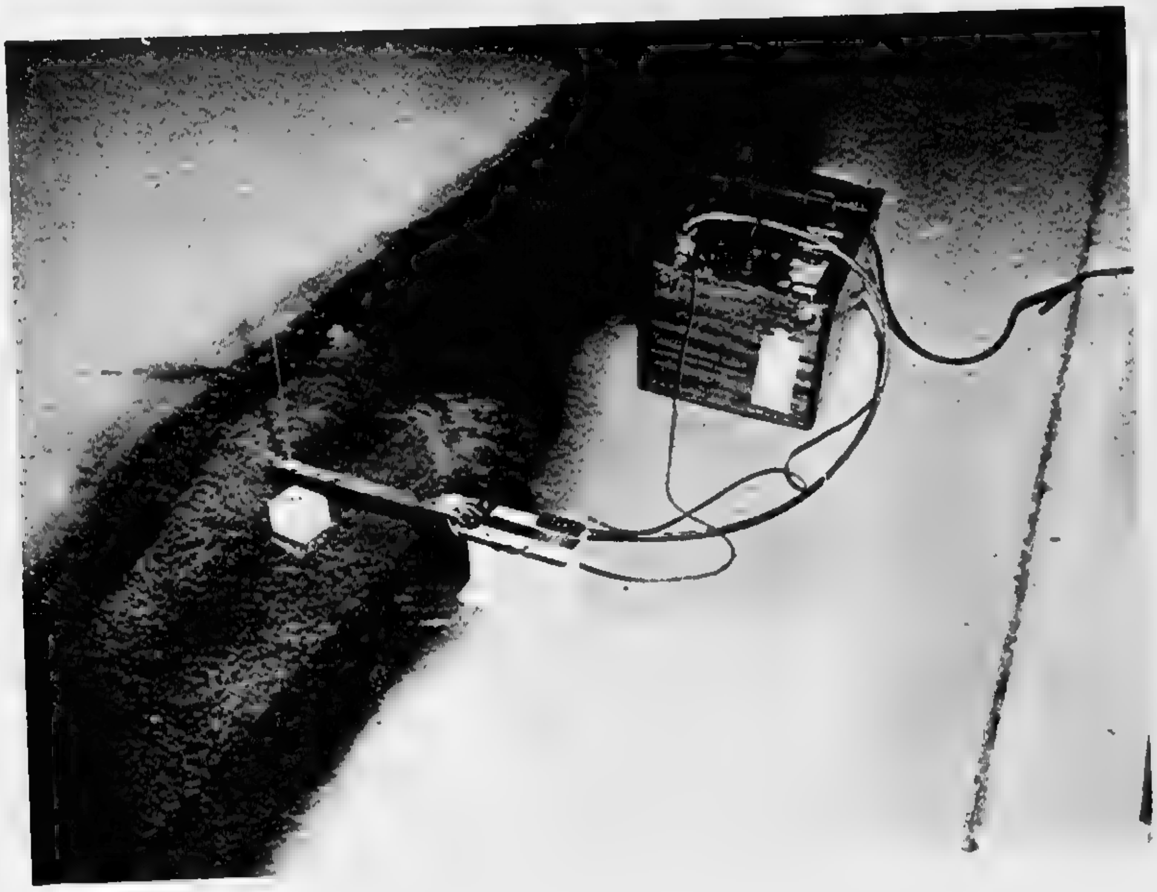


Figure 13. Tidal Elevation Recorder

A second addition, 24 feet by 48 feet, was added to the main model building to house the uniform scale models. (See Figure 14.) Model construction is essentially the same as that of the main model except that most of the model topography and structural shapes are removable to allow major changes of intake and discharge configurations to be made easily and quickly. (See Figures 15 and 16.)

Water is supplied to the uniform scale model through a 12" line from the main model standpipe and can be supplied to either end of the model. A single orifice plate in this 12" line connected to an air-water manometer allows accurate flow measurement. No tidal controls were installed for the uniform scale model and operation was limited to steady state flows.

Waste water from the uniform scale model is returned to the main model sump through return flow channels and pipes similar to return flow from the main model itself. Appropriate piping, valves and pumps are also installed to produce the proper intake and discharge flows and temperatures.

Water temperature is recorded using 24 thermocouples connected to a 24 channel multi-point potentiometric Bristol recorder. Additional temperature recording instrumentation is available as needed using the thermistor-thermometer.

Figure 17 shows the completed 1/50 model in operation including instrumentation. Figures 18 and 19 show the uniform scale model at scale ratios of 1/100 and 1/250 respectively.

Figure 14 1/50 Model Addition

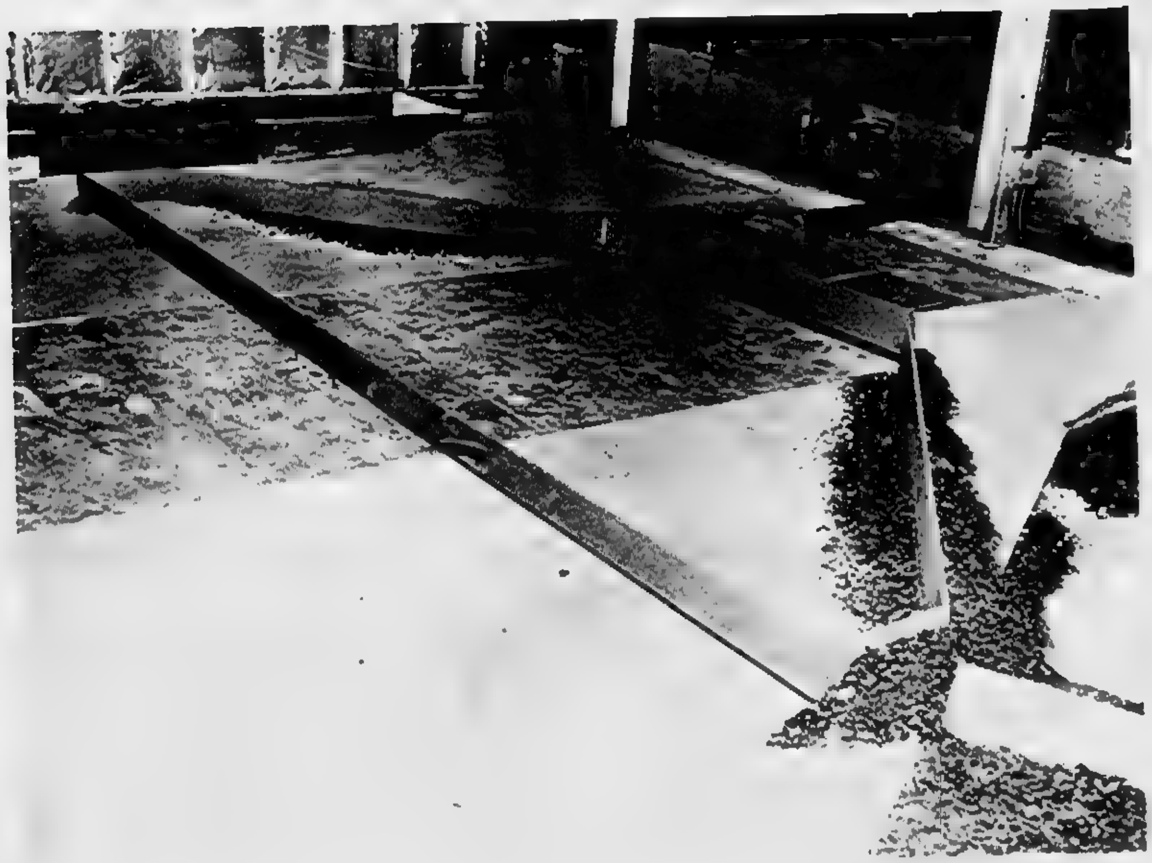


Figure 15 1/50 Model Intake Structure

Figure 16 1/50 Model Discharge Structure

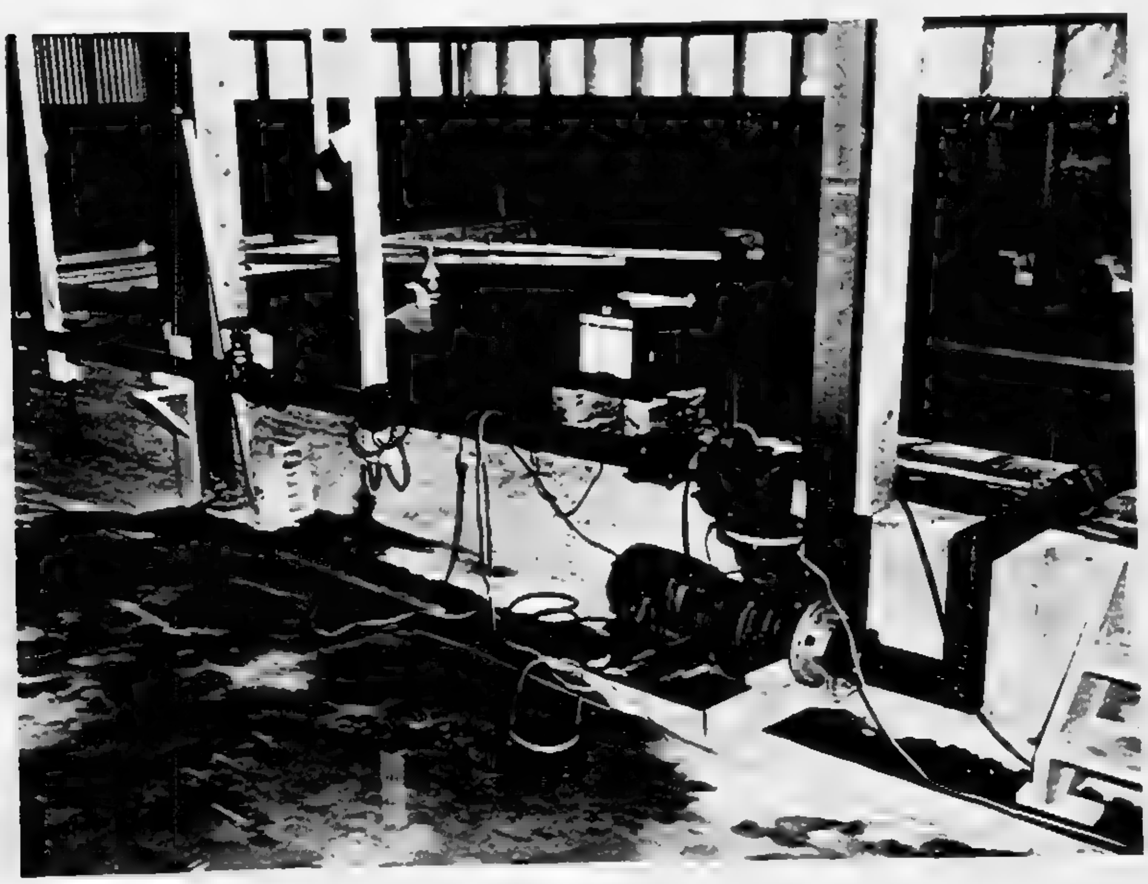


Figure 17 1/50 Model Completed

Figure 18 1/100 Model

Figure 19 1/250 Model

FIELD DATA

Adjustment of the model is dependent entirely on field data which allows the comparison of model and prototype behavior. Of particular importance is the velocity determinations throughout the modeled area. Correctly modeled velocities assure a valid model of the flow patterns for the full range of tides.

An additional consideration for proper model adjustment is the tidal range and water surface elevation change with time.

Velocity data published by the United States Coast and Geodetic Survey in the 1968 Tidal Current Charts, Upper Chesapeake Bay were used as a guide for initial model adjustment.

In addition to the general average data available through U. S. Coast and Geodetic publications, field tests and data collection are necessary to provide local and detailed information. Shepard T. Powell Associates of Baltimore, Maryland provided a substantial amount of information from the field. Additional information was made available from the Philadelphia Academy of Natural Sciences.

Of prime interest to the Laboratories was field determination of velocities at critical sections of the Bay. These velocities were measured by releasing drogues in the field and determining drogue movement by aerial photogrammetry. Drogues were constructed to measure velocities at the water surface, at depths of 15 feet and at depths of 30 feet. Tests were made at several locations, including the model limits and the area near the plant site for both ebb and flood tides.

MODEL ADJUSTMENT AND OPERATION

Before data may be taken to determine the thermal effects of the heated power plant discharge considerable care must be taken to establish the proper environmental conditions.

The prototype tide cycle is one of the primary variables and constitutes a major portion of test program preparation. For a given prototype tide cycle considerable adjustment may be necessary. All model inflows and outflows are compared with the design flows and the elevation versus time relationship at the plant site is checked.

When the performance of the model tide cycle indicates a good comparison with design flows and elevations a series of model drogue studies are conducted. Velocities found from the model drogue studies are then available for direct comparison with the respective field drogue studies. The model studies are accomplished by photographing, from overhead, the traces of candle floats released in the model. The candle floats are constructed to measure velocities at the water surface, at depths of 15 feet and at depths of 30 feet.

The camera lens remains open during the test interval to provide a time-lapse trace of the candle float movement. An interrupter in front of the camera lens provides information to indicate direction of travel and a time interval from which velocities may be calculated.

When the model is producing the correct tide cycle it is then necessary to establish the proper environmental temperatures before thermal test data may be obtained. It is desirable to have the air temperature in the model building less than a few degrees fahrenheit different from the model water temperature. This adjustment

is accomplished by heating the building air with portable oil heaters or by heating the model water with the 100-horsepower boiler, or both.

After the model water temperature and the building air temperature have become steady and at the desired values, and before the model plant discharge is introduced, model water temperatures are measured to determine ambient or base conditions. All temperature recorders are started and temperatures are measured for two or three model tide cycles. The last recorded ambient tide cycle provides a basis for determining if the model has reached an equilibrium with its environment and is used as a base for determining water temperature increase caused by the plant warm water discharge.

The ambient test cycle is followed by the introduction of the heated plant effluent. During early tests (those with low test numbers) a flow of water, equal in magnitude to the plant discharge, was taken from the model through the plant intake structure and discarded to waste. During the test program a model circulating water loop with immersion electrical heaters was developed such that water could be drawn through the intake, heated as required, and discharged directly through the discharge structure.

The model is allowed to operate for several tide cycles as the plant intake and discharge function. During this time the effects of the plant operation on the receiving body of water reach equilibrium for any given phase of the tide cycle. Temperatures at key stations are monitored for stable conditions. The temperature recorders are started again and run for two or three tide cycles. The last recorded tide cycle is

the final data for determining the effects of the heated effluent.

During the last series of tests salinity was added to the discharge flow to simulate anticipated field conditions. The plant condenser cooling flow was established with a 10 F rise from intake to discharge. Saturated saline solution was added from a crock with a FMI pump to the plant piping loop to mix with the fresh water and provide the desired density. The density was measured with a hydrometer graduated in thousandths. The desired density difference was set by measuring the density of a sample of intake water and comparing this result with the density of a sample of heated discharge water. When the specific gravity of the discharge water was less than that of the intake water, a buoyant or positive jet resulted; when the specific gravities were the same a neutral jet resulted; and when the discharge was greater than the intake a negative jet resulted. A buoyant jet was the result of plant heating only. To produce neutral and negative conditions saline solution was added to the plant flow in the appropriate amounts. An analog-digital converter was installed at the model site allowing direct conversion of data to a form easily handled by electronic data processing techniques. In addition, programing was purchased by the Laboratory to make use of computer plotters to plot model data by machine, allowing analysis of greater amounts of data in a shorter period of time.

Operation and adjustment of the uniform scale model is considerably simpler than the larger bay model. A desired design tidal flow is set using the air-water differential manometer and the appropriate valve for flood or ebb flow. Flow ranges may vary from zero, for slack conditions, to maximum predicted flood or ebb. Staff gages are installed in the model and water surface elevation is controlled using movable gates at either end of the model.

Velocities in the uniform scale model may then be checked using miniature velocity meters (stream gage meters) or model floats. By using model floats, flow patterns can be obtained as well as velocity magnitudes.

Following the velocity determinations the temperature recorder is started and temperatures measured for the determination of ambient conditions. Visual monitoring of the recorder chart indicates when steady state conditions have been attained.

The plant intake and discharge flows are then introduced and the temperature rise across the plant set. Velocities may be checked, if desired, to determine plant operation effects and, once again, attained temperatures are recorded as before to determine plant operation thermal effects. Temperatures at a given depth may be obtained by adjusting the movable thermocouple probes and repeating the temperature measurements. As with the larger main model environmental air temperature and humidity is closely controled and monitored during model operation. The plant intake temperature is monitored frequently during the test and the plant discharge temperature adjusted accordingly thus allowing any recirculation effects to be included as part of the test and test data.

The scale of the 1/50 model was changed to a scale of 1/100, by relocating the plant intake with respect to the plant discharge and changing flow magnitudes and water surface elevations. Similarly, the 1/100 scale model was converted to a scale of 1/250.

Results of early tests, in part, determine the conditions for further testing. Therefore later testing, to an increasing degree, reflects the background information and experience previously obtained and evaluated. In addition, certain guidelines and directives were received during the test program which helped to provide direction to the program.

BACKGROUND

Modeling

To study a particular hydraulic condition with a physical model requires that the model conform to the laws of hydraulic similitude. If turbulent flow will exist under prototype conditions, turbulent flow must also exist in the model. In addition, it is generally true that gravity and inertia forces predominate and govern the characteristics of open channel flow.

To meet the first condition of hydraulic similitude the value of Reynolds number (a measure of the amount of turbulence) must at least exceed 500. Reynolds number, N_R, is expressed as:

$$N_R = \frac{VR}{\nu}$$

where: V = velocity in feet per second

R = hydraulic radius in feet

ν = kinematic viscosity in square feet per second

In the case of a tidal flow, the Reynolds number will vary with tidal flow from zero at slack tides to maximum during flood and ebb tides. The model Reynolds number must exceed 500 during that portion of the tide cycle when prototype flow is turbulent.

The second condition of hydraulic similitude requires that the ratio of inertia forces to gravity forces be the same for model and prototype.

The Froude Number as generally applied to "free surface" modeling is the square root of this ratio. The Froude Number N_F is expressed as:

$$N_F = \frac{V}{\sqrt{gD}}$$

where:

V = velocity in feet per second

g = gravitational acceleration in feet per second^2

D = depth of water in feet or head = H

For sufficiently high Reynolds number, model similitude for free surface flow requires that Froude numbers of model and prototype be equal. This requirement in combination with the chosen length ratios and depth determines the various parameter ratios. The length ratio is a prototype length, L_P, divided by the corresponding model length, L_M. The depth ratio may be determined in the same manner and the various physical relationships can be calculated.

It should be noted that the modeling of density or specific weight in accordance with Froude Number equality requires that the ratio between model specific weight and prototype specific weight be unity. When specific weight differences are caused by temperature differences, this requirement will be fulfilled by modeling temperature on a one-to-one basis as well.

Surface Heat Rejection

Surface heat rejection values may be obtained from the plan isotherm plots using the equation:

$$\Delta H = K A \Delta T$$

where:

ΔH is the surface heat rejection in Btu/hr.

K is the model coefficient of heat transfer

A is the water surface area

ΔT is the temperature difference in °F

A value of K equal to 2.2 Btu/sq.ft./°F/hour was selected based upon the results of experiments conducted under similar conditions of model surface heat rejection as prevail at the Calvert Cliffs model. As the data is primarily for comparative purposes the selection of a K value was considered somewhat academic.

Three different ΔT's may be used to calculate a corresponding ΔH:

ΔT_1 - Elevated Surface Water Temperature minus Base River Temperature

ΔT_2 - Elevated Surface Temperature minus Air Dry-Bulb Temperature

ΔT_3 - Elevated Surface Water Temperature minus Air Wet-Bulb Temperature

Unless otherwise stated, surface heat rejection values stated in this report are based on the first case above.

Technique Limitations

In reviewing the data from the Calvert Cliffs model there are a number of aspects that should be pointed out. In operating the model the air temperature and the base water temperature, as well as the wet bulb temperature, are maintained at nearly the same value and are held nearly constant for the testing period. With the model completely enclosed there is no wind over the model and the solar radiation is eliminated. This combination of ambient conditions minimizes the heat transfer aspects of the model and allows flow patterns or hydrodynamic aspects of the model to be evaluated with a minimum of other effects.

The distortion of the model is necessary in order to develop a reasonable size and to provide a depth of water in the model necessary to attain the desired Reynolds number. Since the jet release is designed to be submerged an adjustment is necessary in the

distorted model in order that the buoyant jet reach the surface at the correct position off-shore. The amount of this adjustment was evaluated in the undistorted model and then transferred to the large model.

In evaluating the areas indicated as being subjected to relatively low temperatures it must be understood that the limitations of available instrumentation and model operation are such that small differences in temperature (0.5F) should be interpreted as trends rather than absolute values with a high degree of precision. This type of evaluation would make the 0.5 F isotherms valuable in terms of studying the data and leaves the absolute values in proper perspective. The model operation aspect involves the selection of a base temperature to be used in computing each temperature difference. In such a large model the base temperature must have some variations and, if this is existing, the differential temperatures as determined must reflect these differences.

Salinity

In a model which reproduces only a section of the estuary it is not reasonable to reproduce the salinity distribution with depth which occurs in the prototype. In the upper layers of the estuary the water is quite well mixed and the temperature patterns developed in the model should be representative of those that will occur in the prototype. In order to observe the resultant jet produced by withdrawal of water several parts per thousand more saline than the receiving water the discharge can be modified with salt to produce a jet that is neutrally buoyant or negatively buoyant. These aspects were studied in the model and reported.

In using the heavy jet it must be borne in mind that the model jet will basically sink to the bottom (uniform density model) while in the prototype the jet will only sink to some level above the salinity level from which it is drawn.

In the prototype the salinity will vary with time and consequently the jet buoyancy will be variable. Available field data indicates that the most common field condition will be such that a neutrally buoyant jet will result. Negatively buoyant jets were studied in the range of specific gravity differences from 0.002 to 0.008 covering nearly the entire range of measured field conditions.

MODEL PROGRAM

The model studies of the Calvert Cliffs Plant at Alden Research Laboratories were authorized in October 1967 and construction was begun almost immediately. The construction of model and building continued until the summer of 1968 with the first operation of the model was accomplished in late May 1968.

A program of model adjustment and parallel work on developing field data was being carried out through the Spring and Summer of 1968. Some of the early tests, although designated as tests were primarily used to check and aid in model adjustment. Throughout the testing program new information and techniques were incorporated as they became available to improve the data taking and operating capability.

A summary of the testing program set up in chronological order and grouping the tests in subdivisions as a means of aiding comparisons is given below. The data in each test description is given in prototype units. Detailed data on all tests has been generated and is available for further reference in the progress reports on the model study. In many cases the Intake and Discharge is indicated by "Scheme" numbers. This refers to design drawings prepared by Bechtel Associates of Gaithersburg, Maryland, which are appendicised to this report. The model configuration duplicated in all substantial respects the Bechtel designs. In addition one Group of tests was performed with a discharge structure proposed by Alden Research Laboratories. A line drawing of this design also appears in the appendix.

GROUP I PRELIMINARY TESTS 001 - 003		July and August, 1968
Intake	-50 Channel, No. C. W.	
Discharge	Nozzle at Shoreline = 3± fps	
Flow	Q = 4700 at 12F	
GROUP II TESTS 004 - 006		September, 1968
Intake	No C. W. and -30' C. W., -50' channel	
Discharge	Slot at Shoreline, 20' wide x 26' deep	
Flow	Q = 4700 at 12, 4700 at 13, 5400 at 10	
GROUP III TESTS 007 - 011		October and November, 1968
Intake	-50 Channel, C. W. at -30' and -16' Scheme V	
Discharge	Scheme IV	
Flow	Q = 5400 at 12F	
GROUP IV TESTS 012 - 015		November 1968
Intake	Scheme V	
Discharge	Scheme IIIB	
Flow	Q = 5400 at 14, 5400 at 12, 9700 at 15	
GROUP V 1/50 TESTS		December 1968
GROUP VI TESTS 016 - 017		February, 1969
Intake	Scheme V	
Discharge	Scheme IV and IIIB	
Flow	Q = 5400 at 10	
GROUP VII TESTS 018 - 020		March, 1969
Intake	Scheme V; -50' Channel W/ -16' C. W.	
Discharge	Nozzle (free surface) 10 fps at LWL	
Flow	Q = 5400 at 10F	
GROUP VIII TEST 021 - 023		March, 1969
Intake	Same	
Discharge	900' weir at Elev. -2' = 1.5 - 3 fps	
Flow	Same	
GROUP IX TESTS 024 - 026		March, 1969
Discharge	Scheme IV	
GROUP X TESTS 027 - 028		April, 1969
Discharge	Scheme IIIB with nozzle	
GROUP XI 1/100 TESTS		March, April, 1969
GROUP XII DETAILED DATA OF PREVIOUS TESTS		April, May, 1969

September, 1969

GROUP XIII

Detail Data with Salinity

Intake X

Discharge ARL at 250, 450, 650, 850

GROUP XIV FINAL TESTS

GROUP XV FINAL DETAIL TESTS

MODEL RESULTS

The summary of results indicated below have been given to show in tabular form some details of the test conditions and test results. It should be pointed out that Test 039 covers a test condition which reflects the combination of plant configuration and plant operation that has been developed from all the test and analysis work. The detailed data for Test 039 is included in the appendix to allow complete study.

CALVERT CLIFFS TESTING PROGRAM

GROUP I - PRELIMINARY - 1/16 to 8/1/68

Intake = -50 Channel, No Curtain Wall, -30' Sill

Discharge = Nozzle at Shoreline, -30' Sill, = 3± fps

Flow = 4700 cfs at 12F, 12.67 x 10^9 Btu/hr.

Rel. Hum. = 95 - 99%

Test No.	Δ Air Temp.	Bay Vel.		Surface Heat Rejection			Max. Temp.
		Flood	Ebb	Range	Max.	Min.	
001	8	2.5	1.1	17-52%	Ebb	Flood	5F at LWS 4F all others
002	10	1.5	1.4	13-38%	Flood	Ebb	2F all
003	4	1.4	1.5	9-13%	HWS	LWS	4F all

GROUP II - 8/27 to 10/1/68

Intake = -50' Channel, -30' Sill, No Curtain Wall and -30' Curtain Wall

Discharge = Slot and Shoreline, 20' wide from Elev. 0 (LWL) to -26', A = 520 ft^{-2}

Conditions

Test No.	Cur-Tain Wall	Q cfs	v ft/s	ΔT F	Heat Input btu/hr.	Flood	Ebb	Bay Temp. F	ΔAir Temp.	Rel. Hum.
004	None	4700	9.0	12	12.67	1.4	1.5	73	7	71
005	-30'	4700	9.0	13	13.73	1.0	1.1	75	0	94
006	-30'	5400	10.4	10	12.13	1.0	1.1	84	-1	95

Results

Test No.	Heat Input btu/hr	Surface Heat Rejection Range %	Max.	Min.	Max. Temp.	
004	12.67	54-66	Flood	LWS	6 F at 5F at	Slacks Flood and Ebb
005	13.73	21-40	Flood	HWS		3F all
006	12.13	56-72	Flood	Ebb	1.5F 2F	LWS and Flood HWS and Ebb

GROUP III - 10/29 - 11/14/69

Intake = -30' C.W., -30' Sill to same, -16' C.W. to Scheme V

Discharge = Scheme IV

Plant Flow = Q = 5400, ΔT = 12°F, Heat Input = 14.56×10^9 btu/hr

Bay Velocities = Flood = 1.0 ft/s, Ebb = 1.1 ft/s

Test No.	Bay Temp F	Δ Air Temp. F	Rel. Hum.	Surface Heat Rejection Range %	Max	Min.	Max. Temp.	Intake
007	72	-9	97	5-9	HWS	Ebb	1F at LWS 2 others	-30' C.W.
008	59	-1	100	7-14	HWS	LWS	1.5F at HWS 1 other	-16' C.W.
009	70	+2	91	45-62	Ebb	LWS	2F at LWS and Flood 1.5F HWS and Ebb	-16' C.W.
010	70	+1	91	9-14	Ebb	Flood	1.5F at LWS 1F all others	Scheme V
011	73	-2	88	20-77	LWS	HWS	1F at Flood 1.5F all others	Scheme V

GROUP IV - 11/15 - 11/27/68

Intake Scheme V

Discharge Scheme III B

Bay Velocities 0.95 - 1.0 ft/s Flood; 1.05 - 1.1 ft/s Ebb

Rel. Humidity 90 - 92%

Test No.	Q cfs	v ft/s	ΔT F	Heat Input btu/hr.	Bay Temp	ΔAir Temp.	Surf. Heat Rej. Range	Max.	Min.	Max. Temp.
012	5400	8.9	14	16.98	69	+1	14-17	Flood	LWS	5 at LWS, Ebb 8 at Flood, HWS
013	5400	8.9	14	16.98	58	0	10-16	Flood and Ebb		5 at ebb 4 all others
014	5400	8.9	12	14.56	78	-6	13-17	HWS	LWS andEbb	4 at LWS 5 at all others
015	4700	7.7	15	15.84	70	0	13-19	HWS	LWS	3 at LWS 4 at Flood, HWS 6 at Ebb

GROUP V UNIFORM SCALE MODEL TESTS AT 1/50 - 12/30/68 to 1/15/69

Intake Scheme VI

Discharge Scheme IIIB

Jet Velocities and Heat for:

Slack, Ebb, Max. Ebb, Flood, Max. Flood

GROUP VI 3/10/69

Intake Scheme V

Plant Flow Q = 5400 cfs, ΔT = 10F, Heat Input = 12.13 btu/hr

Bay Velocities 2.7 Flood and Ebb

Environment:

Bay Temp. = 71F, Δ Air Temp. = +1F, Rel. Hum. = 85%

Test No.	Discharge	Surface Heat Rejection Range %	Max.	Min.	Max. Temp.
016	Scheme IV	12–17	HWS, Ebb	LWS	2F
017	Scheme III B	6–11	LWS	Flood	3F at LWS, Flood 2.F at HWS 2.5F at Ebb

GROUP VII 3/12/69 - 3/14/69

Intake Scheme V to -50' Channel, -30' Sill, - 16' C.W. to same

Discharge 10 fps nozzle (Free surface) v = 10 fps at LWL
= 9.1 fps at HWL

Plant Flow Q = 5400 cfs, ΔT = 10F, Heat Input = 12.13 btu/hr.

Environment Rel. Hum. = 85 - 87%

Test No.	Bay Vel's Flood	Bay Vel's Ebb	Bay Temp F	Δ Air Temp F	Surface Heat Rejection Range %	Max.	Min.	Max. Temp.
018	2.7	2.7	70	+3	9–14	LWS	Ebb	2F at Ebb and LWS 3F at Flood and HWS
019	2.7	2.7	70	+1	10–11	Flood	HWS, Ebb, LWS	1.5F at Ebb and LWS 3F at Flood and HWS
020	2.2	2.0	75	+2	33–53	HWS	LWS	2F at LWS 3F at all others

GROUP VIII 3/26–27/69

Intake Scheme V to –50 Channel, – 30' C.W., –26' Sill to same

Discharge 900' weir at –2' $v = 1.5$ to 3 fps

Plant Flow $Q = 5400$ cfs, $\Delta T = 10F$, Heat Input $= 12.13 \times 10^9$ btu/hr.

Bay Velocities Flood = 2.0 ft/s, Ebb = 2.6 ft/s

Test No.	Bay Temp F	Δ Air Temp. F	Rel. Hum.	Surface Heat Rejection Range %	Max.	Min.	Max. Temp
021	66	+1	89	16–28	Ebb	Flood, HWS	6F at Flood and HWS 4F at Ebb and LWS
022	66	0	94	8–20	Ebb	HWS	1.5F at Flood 4F at HWS and Ebb 3F at LWS
023	75	+2	87	8–13	Ebb	Flood	2F at Ebb 3F at LWS and HWS 4F at Flood

GROUP IX 3/28–29/69

Intake Scheme V to –50 Channel, –30' C.W., –26' Sill to Same

Discharge Scheme VI

Plant Flow $Q = 5400$ cfs $\Delta T = 10F$, Heat Input $= 12.13 \times 10^9$ btu/hr.

Bay Velocities:
Flood = 2.0, Ebb = 2.6

Test No.	Bay Temp F	Δ Air Temp F	Rel Hum	Surface Heat Rejection Range %	Max.	Min.	Max. Temp.
024	67	+2	98	9–19	Ebb	HWS	1.5F at LWS, 2F at Flood and HWS 3 F at Ebb
025	67	+3	95	28–42	Ebb	HWS	1.5F at Slacks, 2F at Flood and Ebb
026	76	+2	87	9–19	LWS	HWS	1.5F at Ebb and LWS, 2F at Flood and HWS

GROUP X 4/22/69

Intake -50 Channel, -30' C. W., -26' Sill

Discharge Scheme III B with Nozzle, v = 9.1 - 10.0 ft/sec.

Plant Flow Q = 5400 cfs, ΔT = 10F, Heat Input = 12.13 x 10^5 btu/hr.

Bay Velocities
Flood = 1.9 ft/sec., Ebb = 1.8 ft/sec

Environment Bay Temperature = 75F

Test No.	Δ Air Temp. F	Rel. Hum	Surface Heat Rejection Range %	Max.	Min.	Maximum Temperature
027	-2	91	22–30	Ebb	LWS	2F at Ebb, 3F at Slacks, 4F at Flood
028	-1	89	9–14	Flood	HWS	3F at LWS, 5F at Flood, 4F at HWS and Ebb

GROUP XI UNIFORM SCALE MODEL TESTS AT 1/100, March and April, 1969

Intake Scheme VI

Discharge Scheme III B

Jet Velocities and Heat for Slack, Ebb, Max. Ebb, Flood, Max. Flood

GROUP XII April, May, 1969

Detailed Data of previous tests

007, 016, 018, 019, 021, 022, 024, 025, 027, 028

GROUP XIII September, 1969

Detailed Data with Salinity

Intake Scheme X

Discharge ARL Proposed at X' from shore, v = 10 ft/s

Bay Velocities
Flood = 1.2 ft/s, Ebb = 1.4 ft/s

Test No.	X	Buoyancy	Δ Sp. Gr.
029	850'	+	+ 0.002
030	650'	+	+ 0.002
031	450'	+	+ 0.002
032	250'	+	+ 0.002
033	250'	-	- 0.007
034	250'	-	- 0.002
035	850'	-	- 0.002
036	850'	-	- 0.007
037	850'	-	- 0.004 - 0.005

GROUP XIV October, 1969

Intake Scheme X

Discharge Scheme V

Plant Flow $Q = 5400$ cfs, $\Delta T = 10$ F, Heat Input $= 12.13 \times 10^9$ btu/hr.

Bay Velocities

Flood = 1.8 ft/s, Ebb = 2.5 ft/s

Environment Bay Temperature = 69 - 71F, Δ Air Temperature = 0 to +2F

Rel. Hum. = 92 - 98%

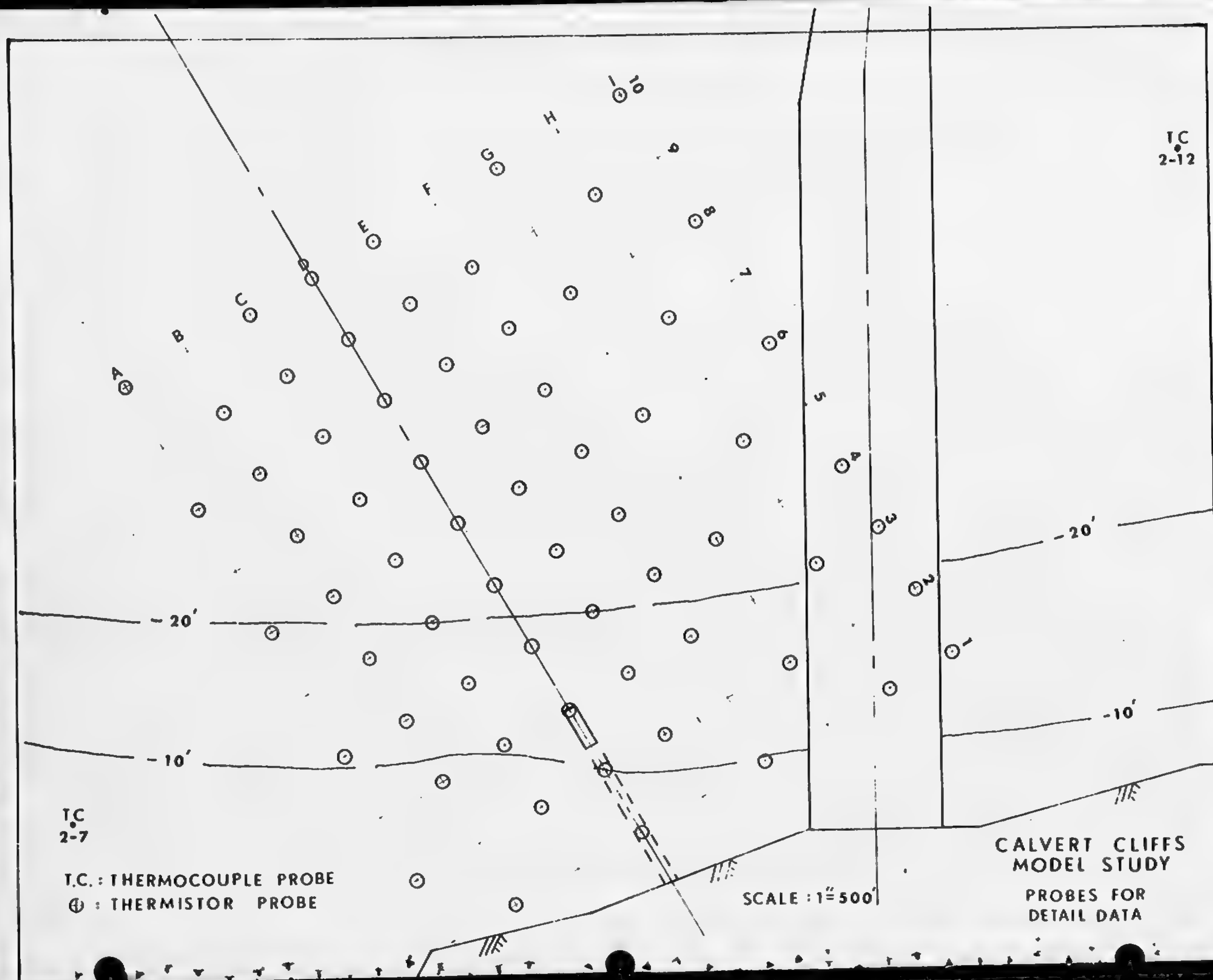
Test No.	Jet Buoy	Surface Heat Rejection Range %	Max.	Min.	Maximum Temperature
038	+	5-11	Ebb	Flood	1.5 F at LWS, 3F all others
039	0	4-8	HWS	LWS, Flood	4F all
040	0	6-12	HWS	LWS	3F at LWS, 5F all others
041	-	3-10	LWS	Flood	1.5F at LWS, 3F at Flood and Ebb, 4F at HWS
042	0	7-9	LWS	Flood	3F all

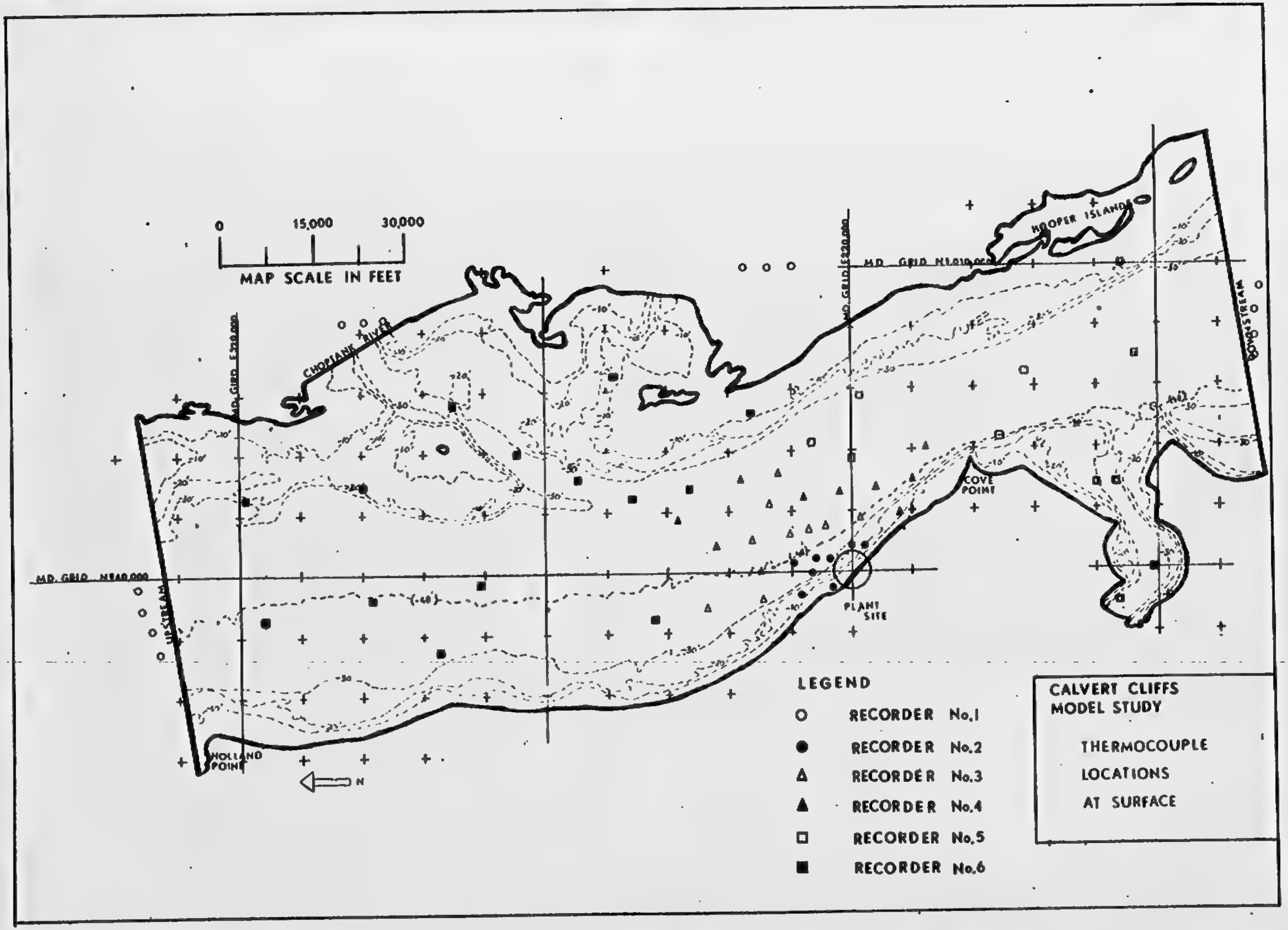
Note: 039 = 040 = 042

GROUP XV October, 1969

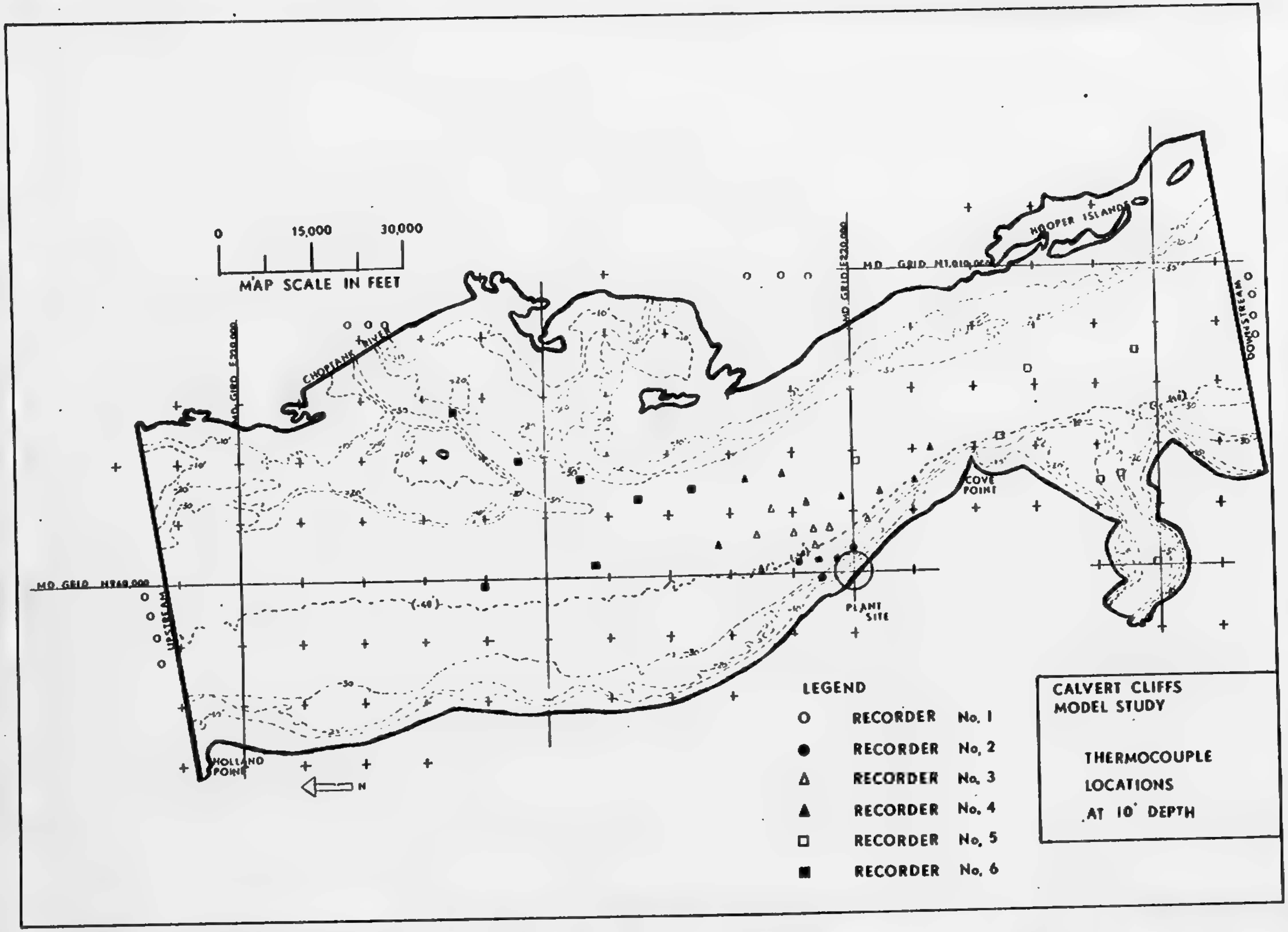
Detailed Tests of 038, 039 and 041

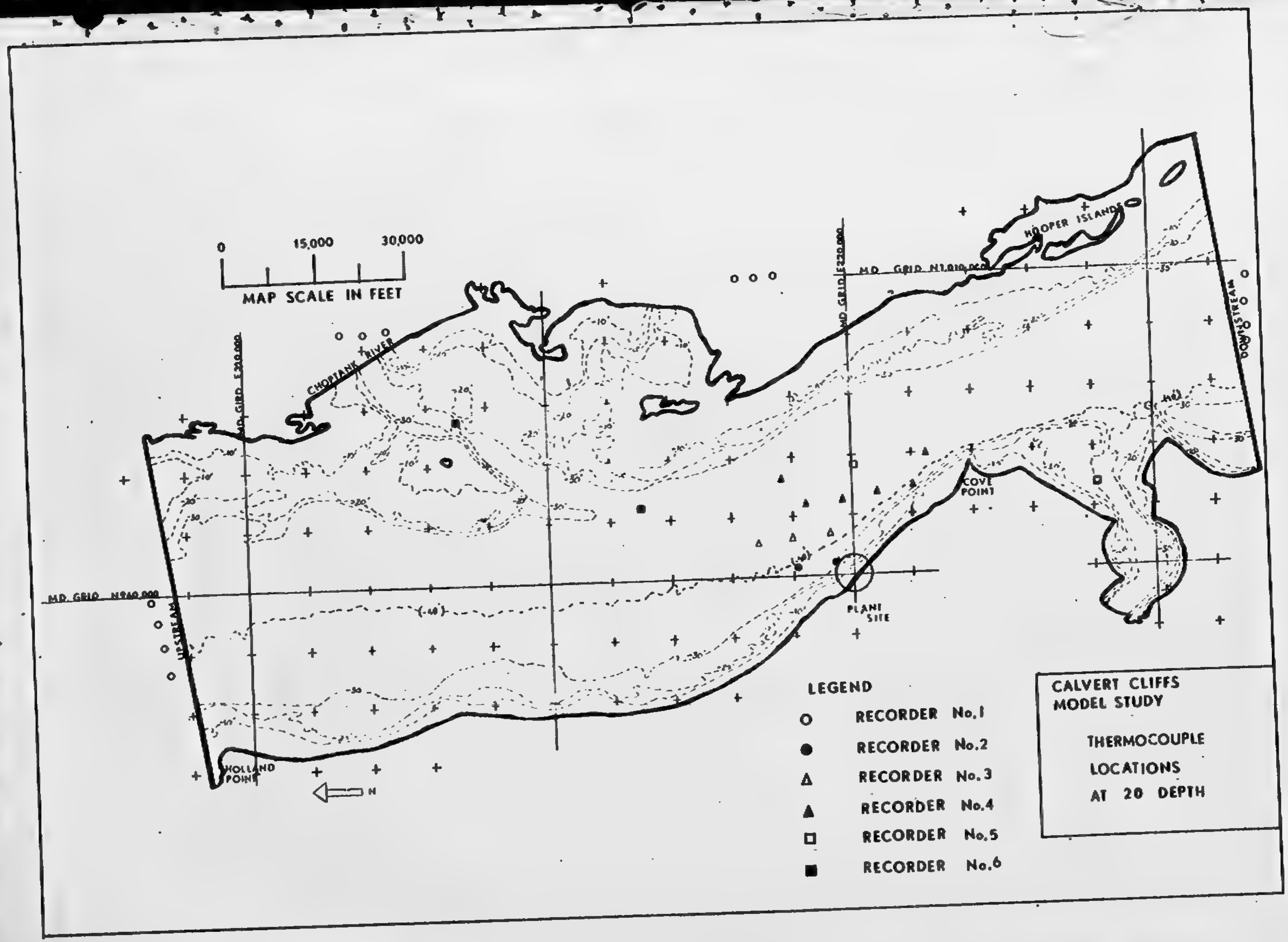
APPENDIX


CALVERT CLIFFS
MODEL STUDY
PROBES FOR
DETAIL DATA
SCALE : 1" = 500'
T.C. : THERMOCOUPLE PROBE
⊕ : THERMISTOR PROBE
T.C.
2-12
T.C.
2-7
-20'
-10'
A
B
C
D
E
F
G
H
I
1
2
3
4
5
6
7
8
9
10

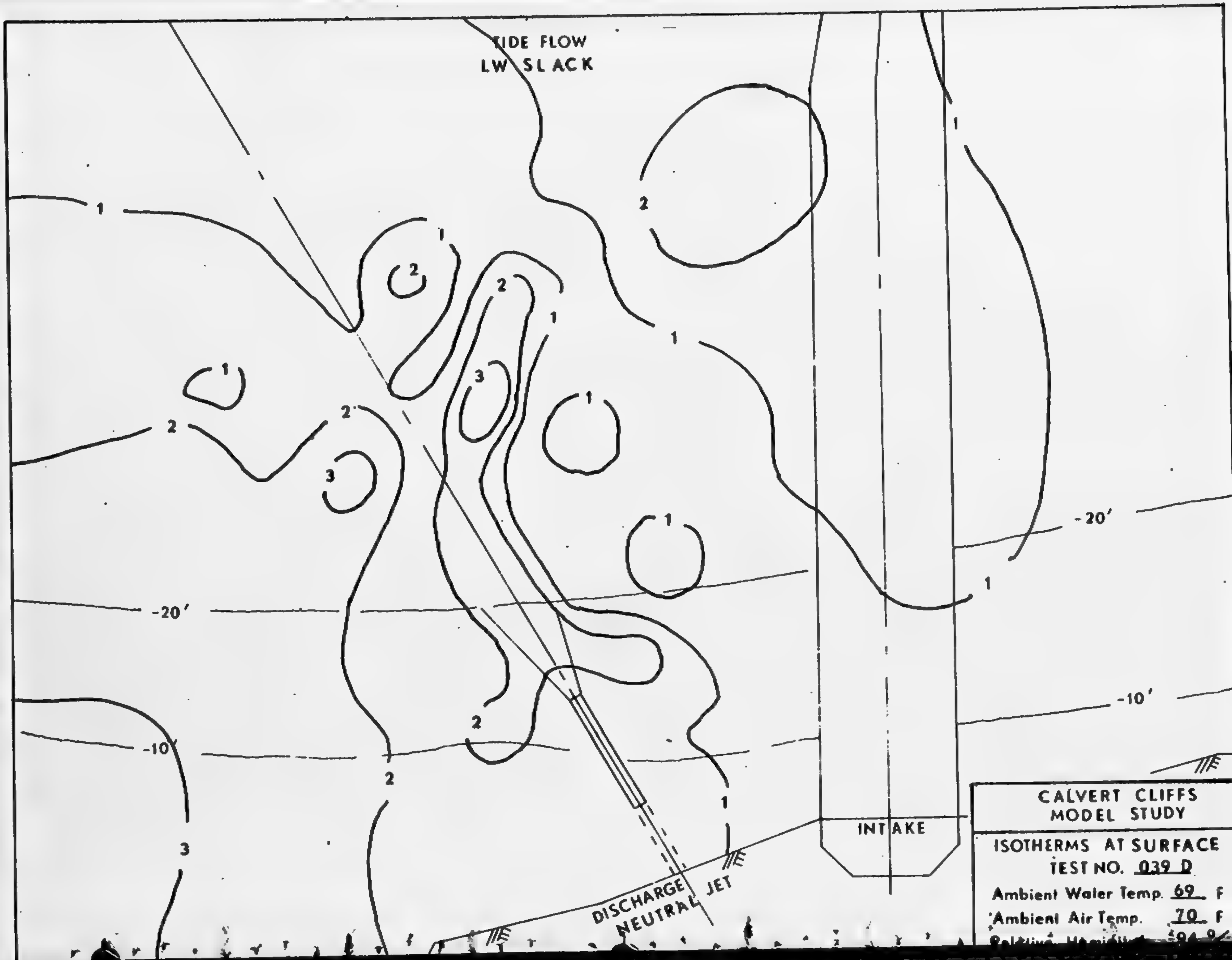


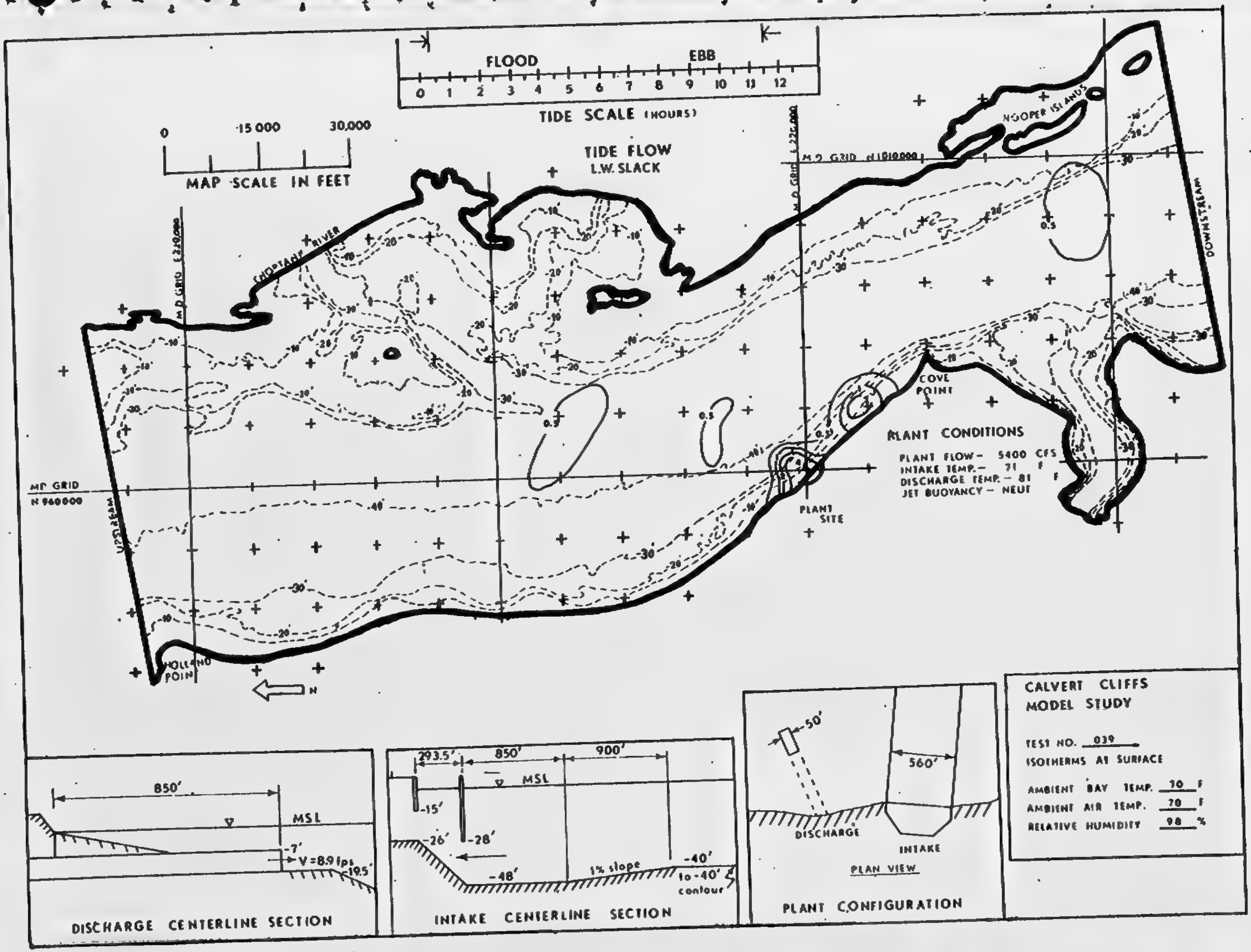
0
15,000
30,000
MAP SCALE IN FEET
CHOPTANK RIVER
HOOPER ISLAND
COVE POINT
PLANT SITE
HOLLAND POINT
UPSTREAM
DOWNSTREAM
N
LEGEND
RECORDER No.1
RECORDER No.2
RECORDER No.3
RECORDER No.4
RECORDER No.5
RECORDER No.6
CALVERT CLIFFS
MODEL STUDY
THERMOCOUPLE
LOCATIONS
AT SURFACE

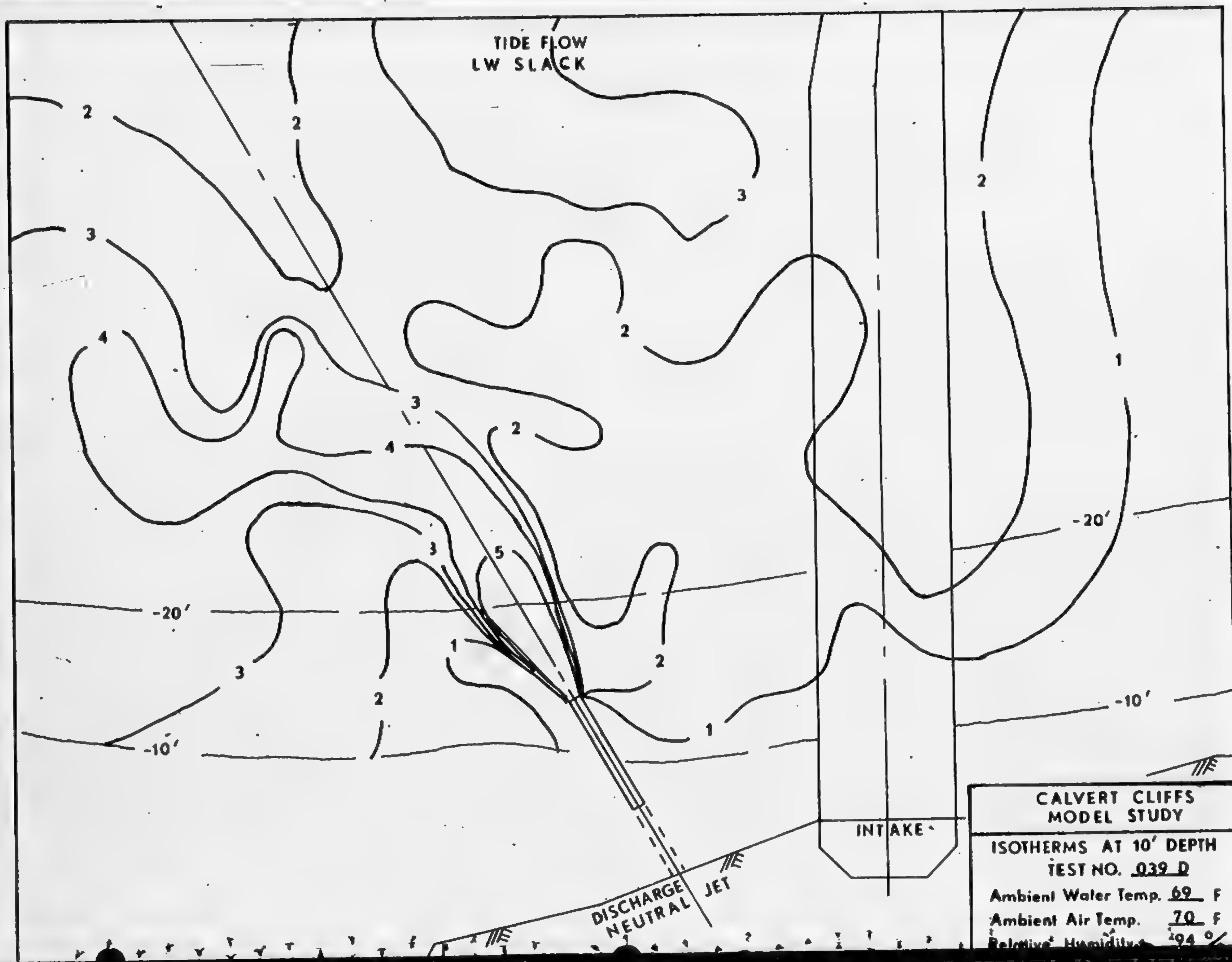

CALVERT CLIFFS
MODEL STUDY
THERMOCOUPLE
LOCATIONS
AT 10' DEPTH
LEGEND
RECORDER No. 1
RECORDER No. 2
RECORDER No. 3
RECORDER No. 4
RECORDER No. 5
RECORDER No. 6
MAP SCALE IN FEET
0
15,000
30,000
HOOPER ISLANDS
CHOPTANK RIVER
COVE POINT
PLANT SITE
HOLLAND POINT
UPSTREAM
DOWNSTREAM
MD GRID N1,010,000
MD GRID E220,000
MD GRID N960,000
MD GRID E320,000
N
(-40')

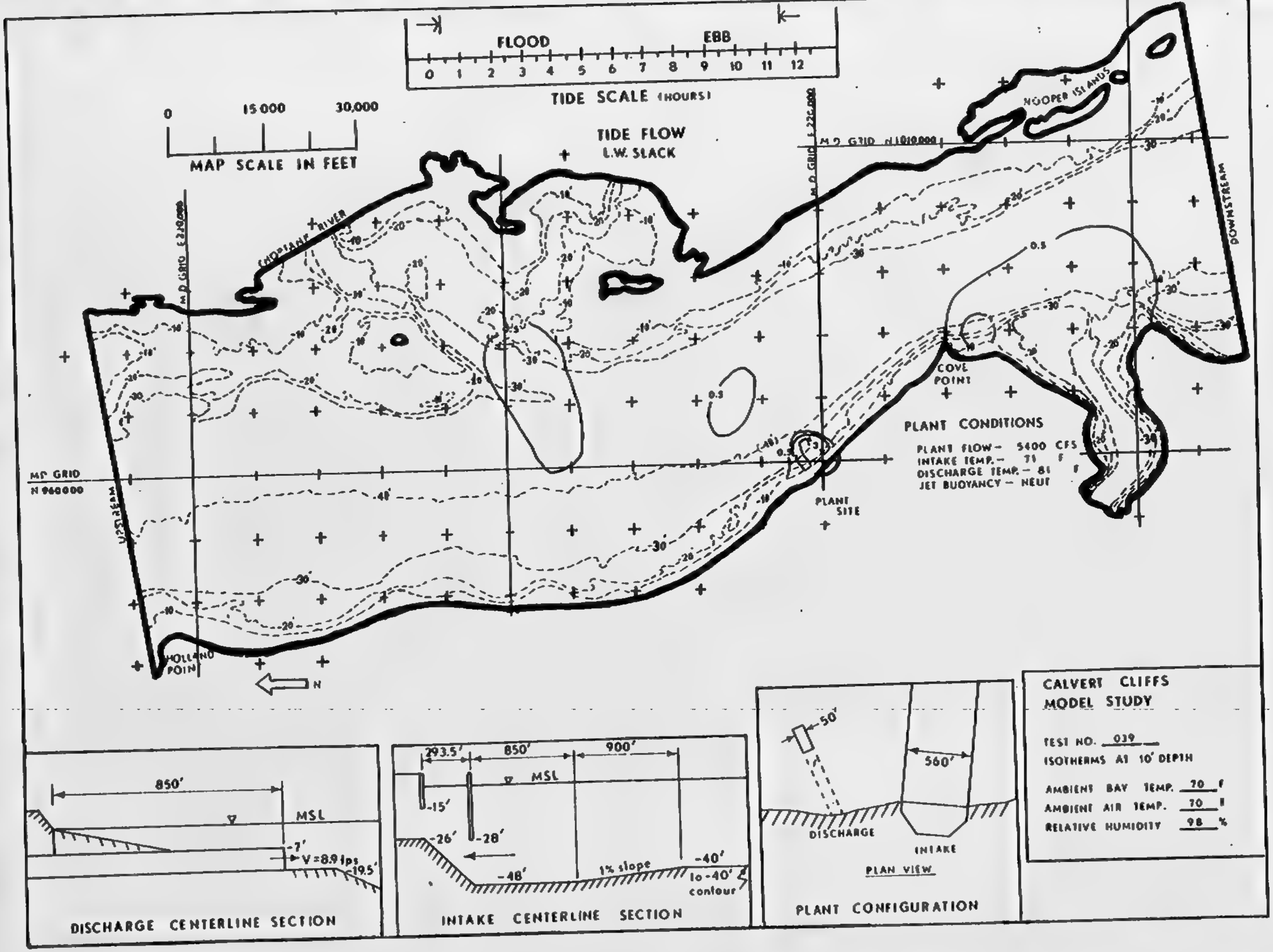


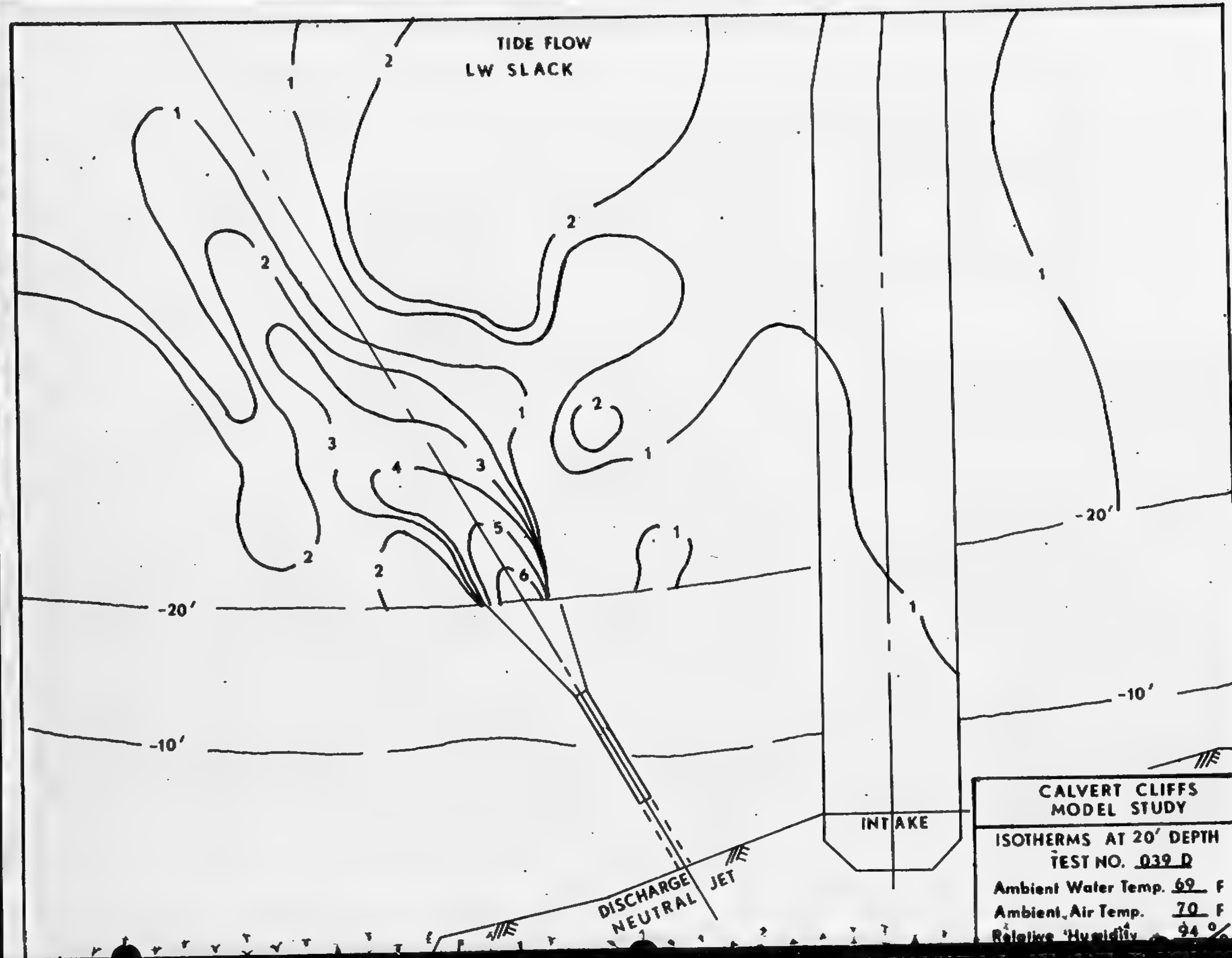
0
15,000
30,000
MAP SCALE IN FEET
CHOPTANK RIVER
HOOPER ISLANDS
MD. GRID N1,010,000
MD. GRID E220,000
MD. GRID E290,000
MD. GRID N940,000
UPSTREAM
DOWNSTREAM
HOLLAND POINT
COVE POINT
PLANT SITE
N
LEGEND
RECORDER No.1
RECORDER No.2
RECORDER No.3
RECORDER No.4
RECORDER No.5
RECORDER No.6
CALVERT CLIFFS MODEL STUDY
THERMOCOUPLE LOCATIONS AT 20 DEPTH

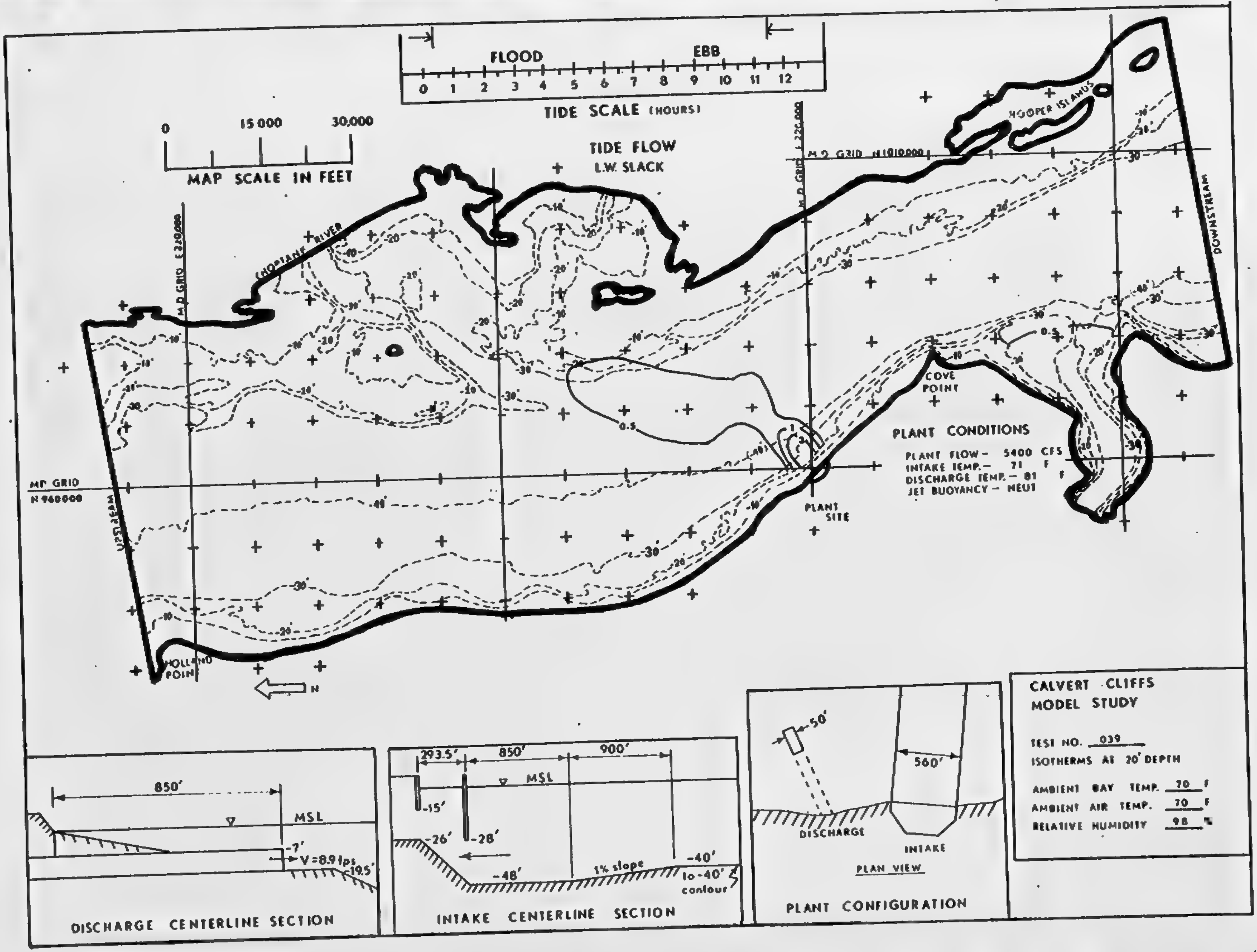

TIDE FLOW
LW SLACK
INTAKE
DISCHARGE JET
NEUTRAL
-20'
-10'
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT SURFACE
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F

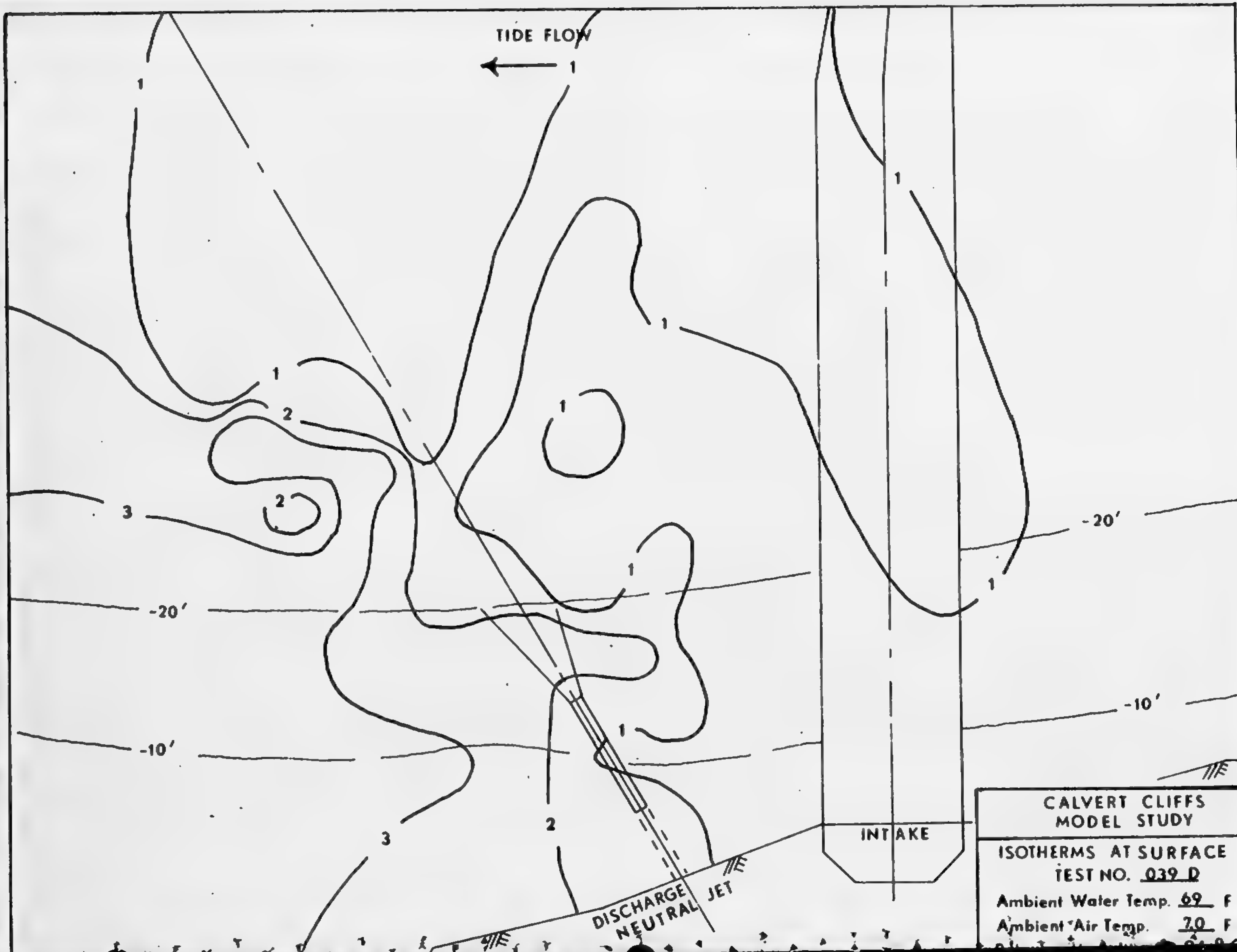

FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
TIDE FLOW
L.W. SLACK
0 15 000 30,000
MAP SCALE IN FEET
HOOPER ISLANDS
CHOPTANK RIVER
DOWNSTREAM
UPSTREAM
COVE POINT
PLANT SITE
HOLLAND POINT
N
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT SURFACE
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
MSL
-15'
-26'
-28'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION

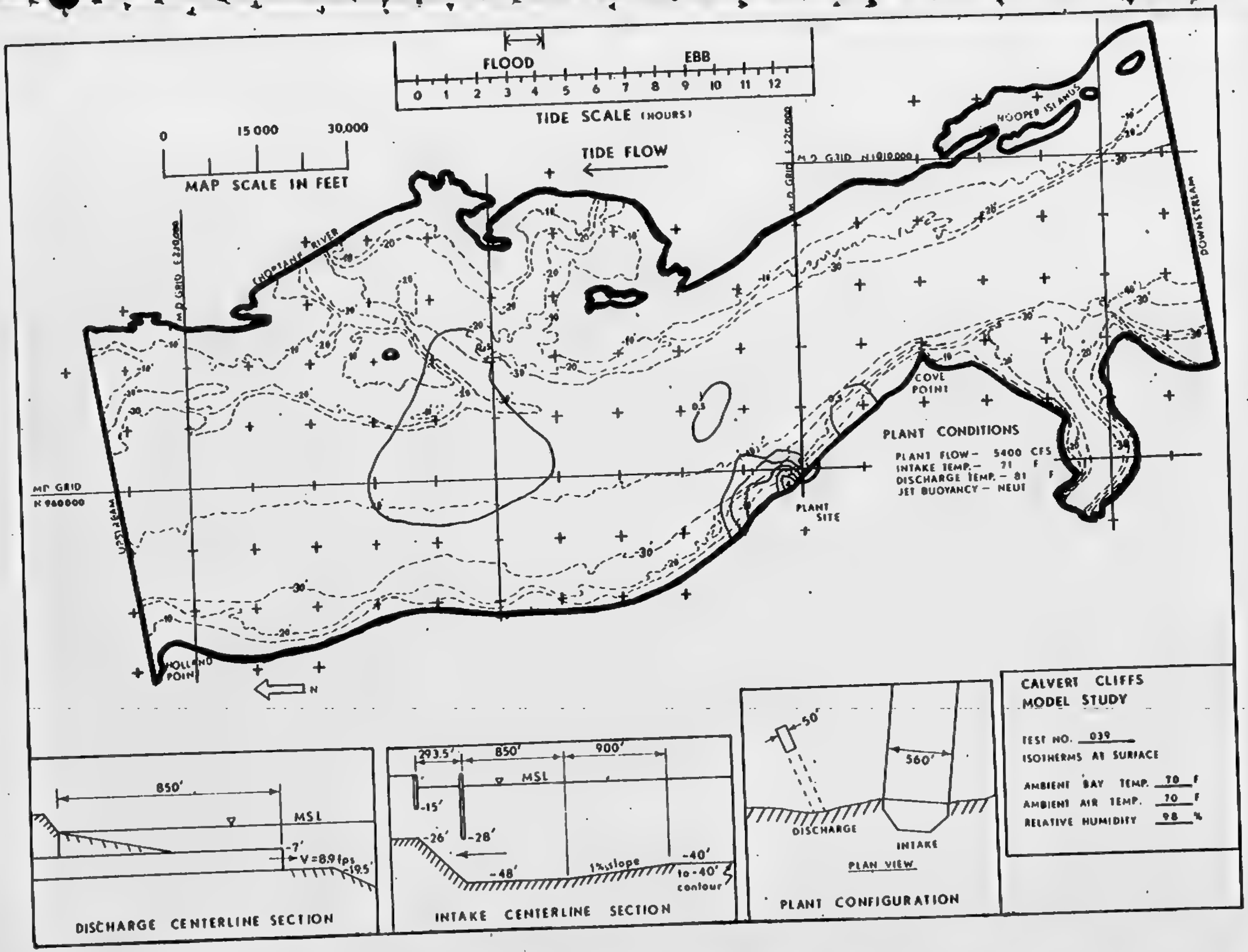

TIDE FLOW
LW SLACK
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT 10' DEPTH
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F
INTAKE
DISCHARGE JET
NEUTRAL
-20'
-10'
1
2
3
4
5

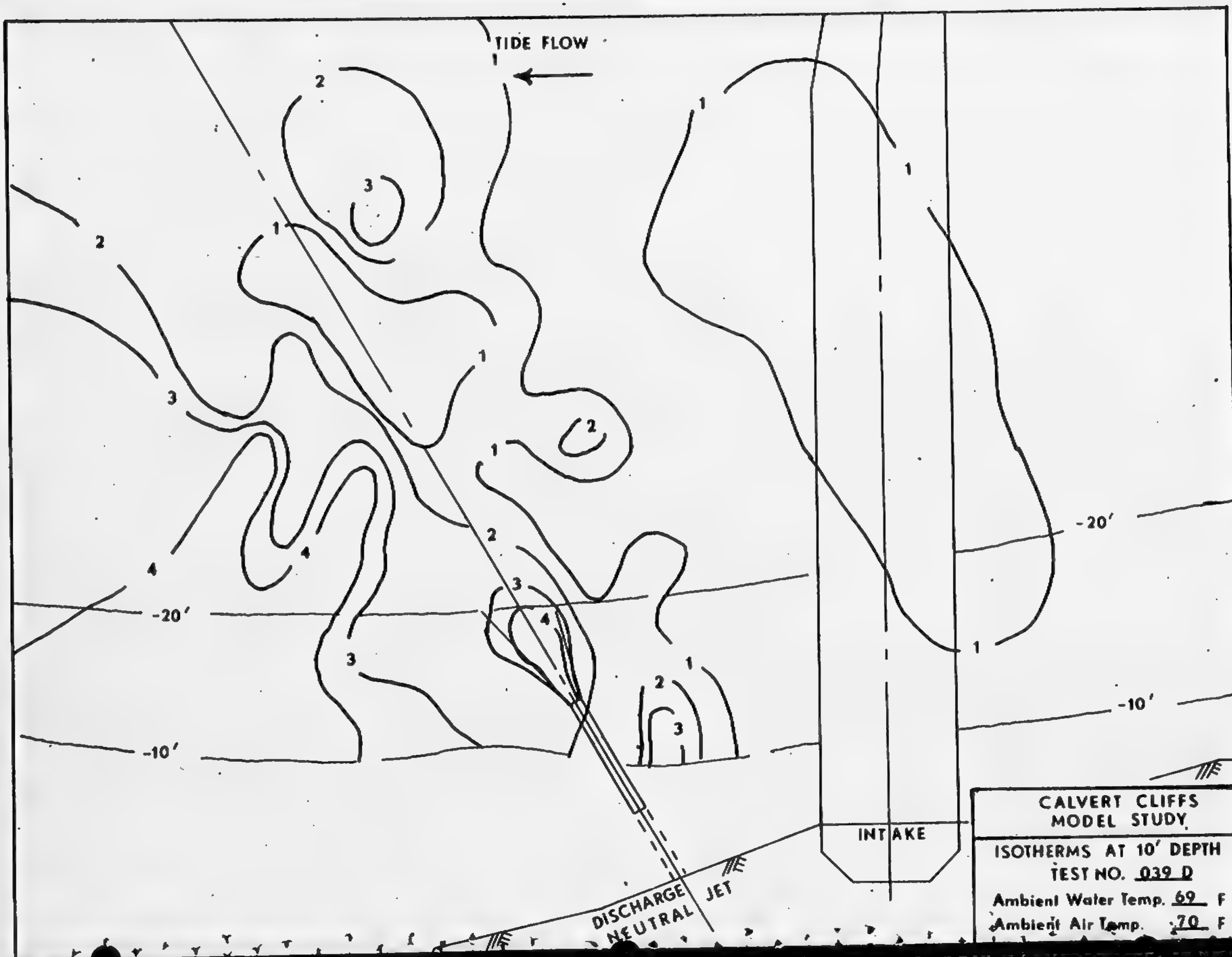

FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0 15,000 30,000
MAP SCALE IN FEET
TIDE FLOW
L.W. SLACK
HOOPER ISLANDS
CHOPTANK RIVER
M.D. GRID N 1010,000
M.D. GRID E 225,000
M.D. GRID E 320,000
MD GRID N 960000
UPSTREAM
DOWNSTREAM
COVE POINT
PLANT SITE
HOLLAND POINT
N
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT 10' DEPTH
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
-15'
-26'
-28'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION

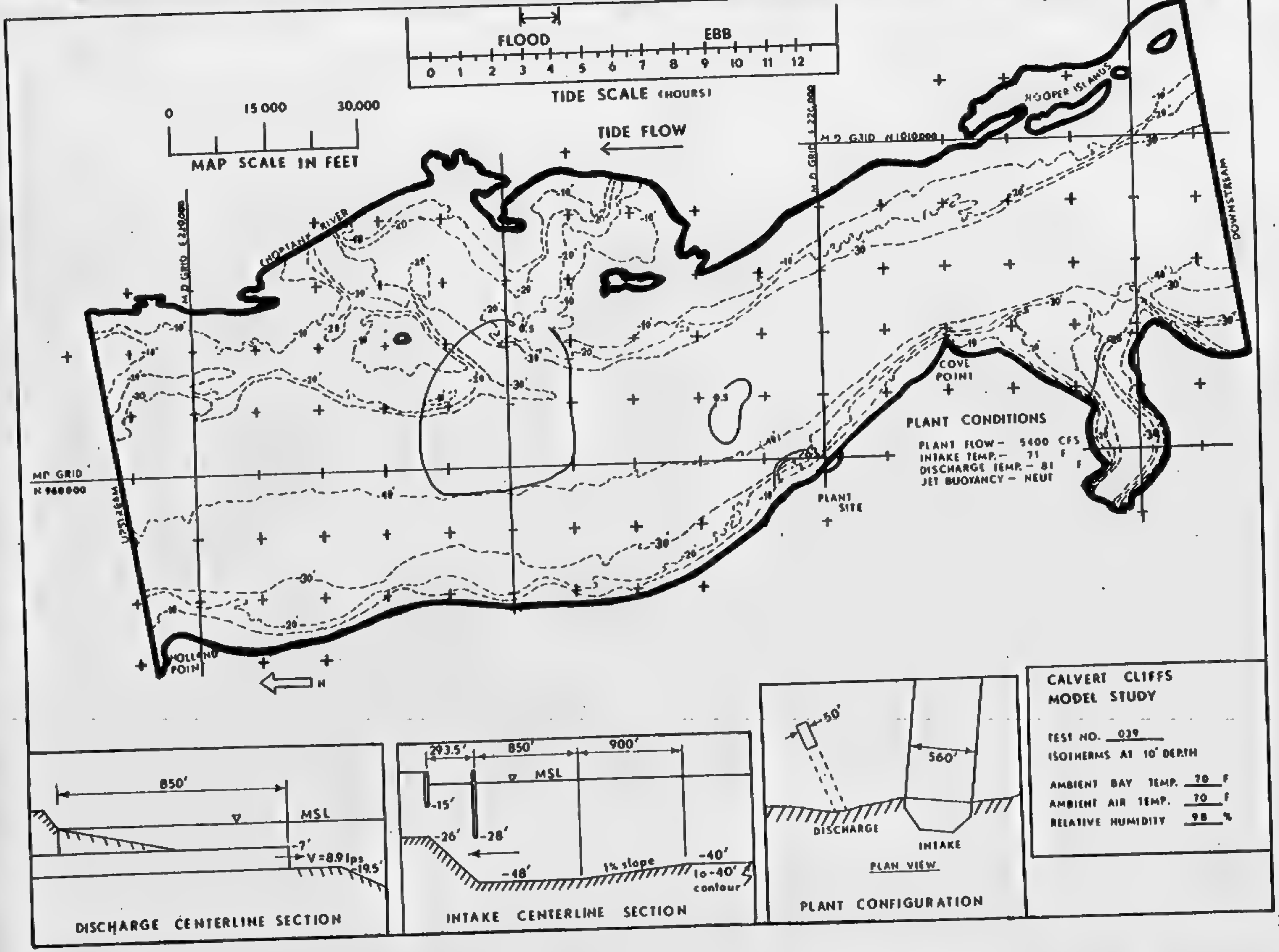

TIDE FLOW
LW SLACK
1
2
3
4
5
6
-20'
-10'
INTAKE
DISCHARGE
NEUTRAL
JET
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT 20' DEPTH
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F
Relative Humidity 94 %

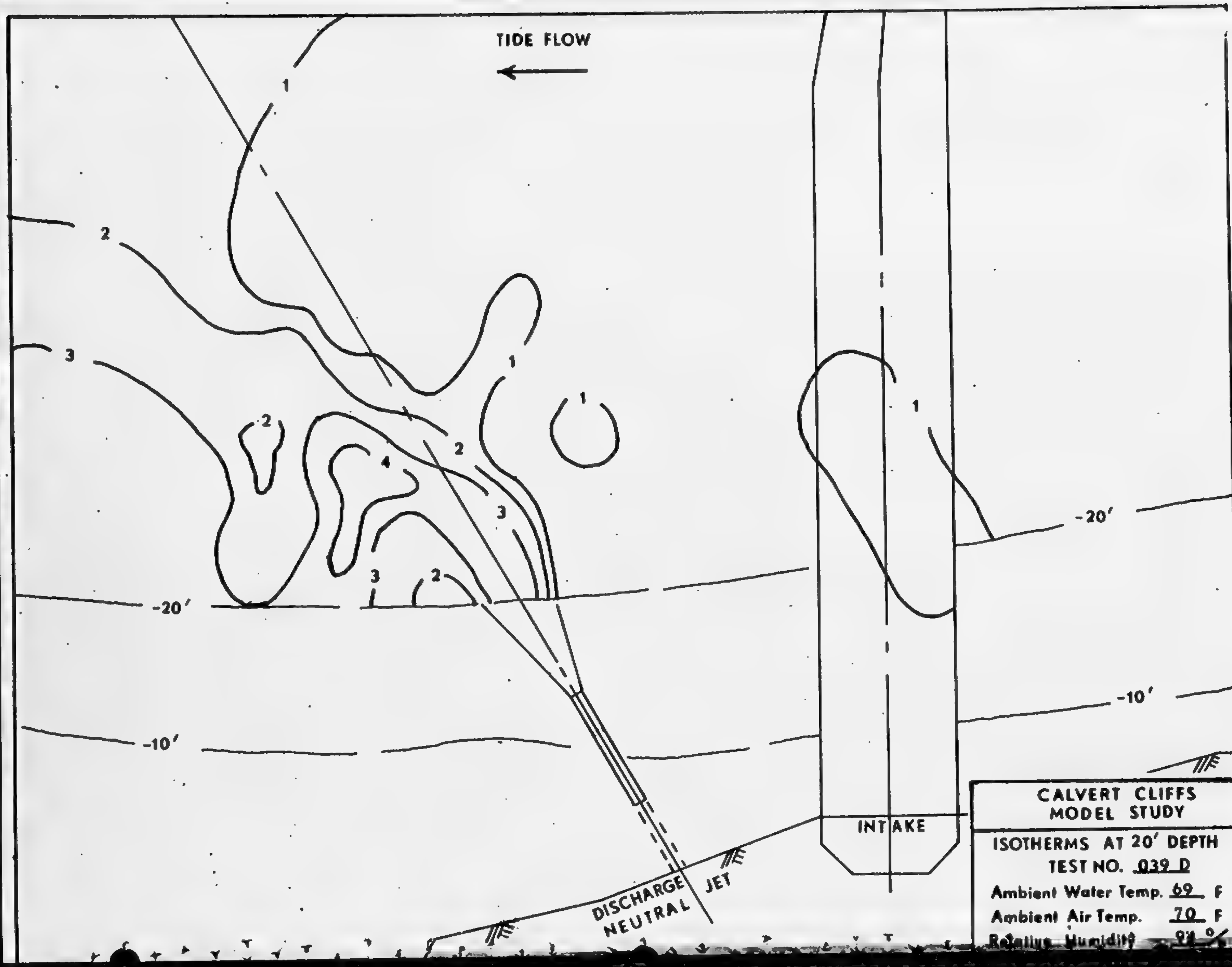

FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0
15 000
30,000
MAP SCALE IN FEET
TIDE FLOW
L.W. SLACK
HOOPER ISLANDS
CHOPTANK RIVER
COVE POINT
PLANT SITE
HOLLAND POINT
UPSTREAM
DOWNSTREAM
M.D. GRID N 960000
M.D. GRID E 220,000
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
N
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
MSL
-15'
-26'
-28'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT 20' DEPTH
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %

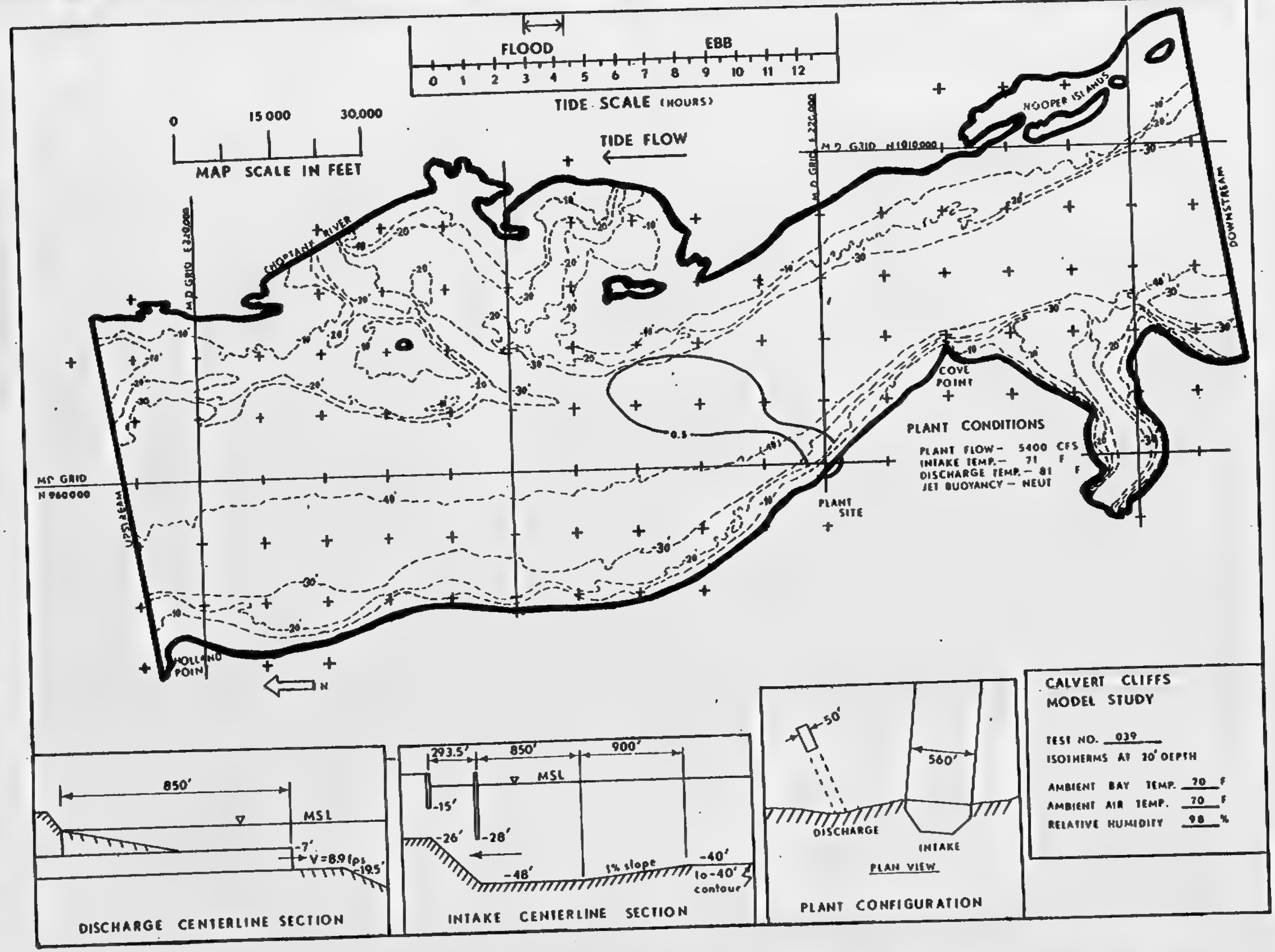

CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT SURFACE
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F
TIDE FLOW
INTAKE
DISCHARGE JET
NEUTRAL
-20'
-10'
1
2
3

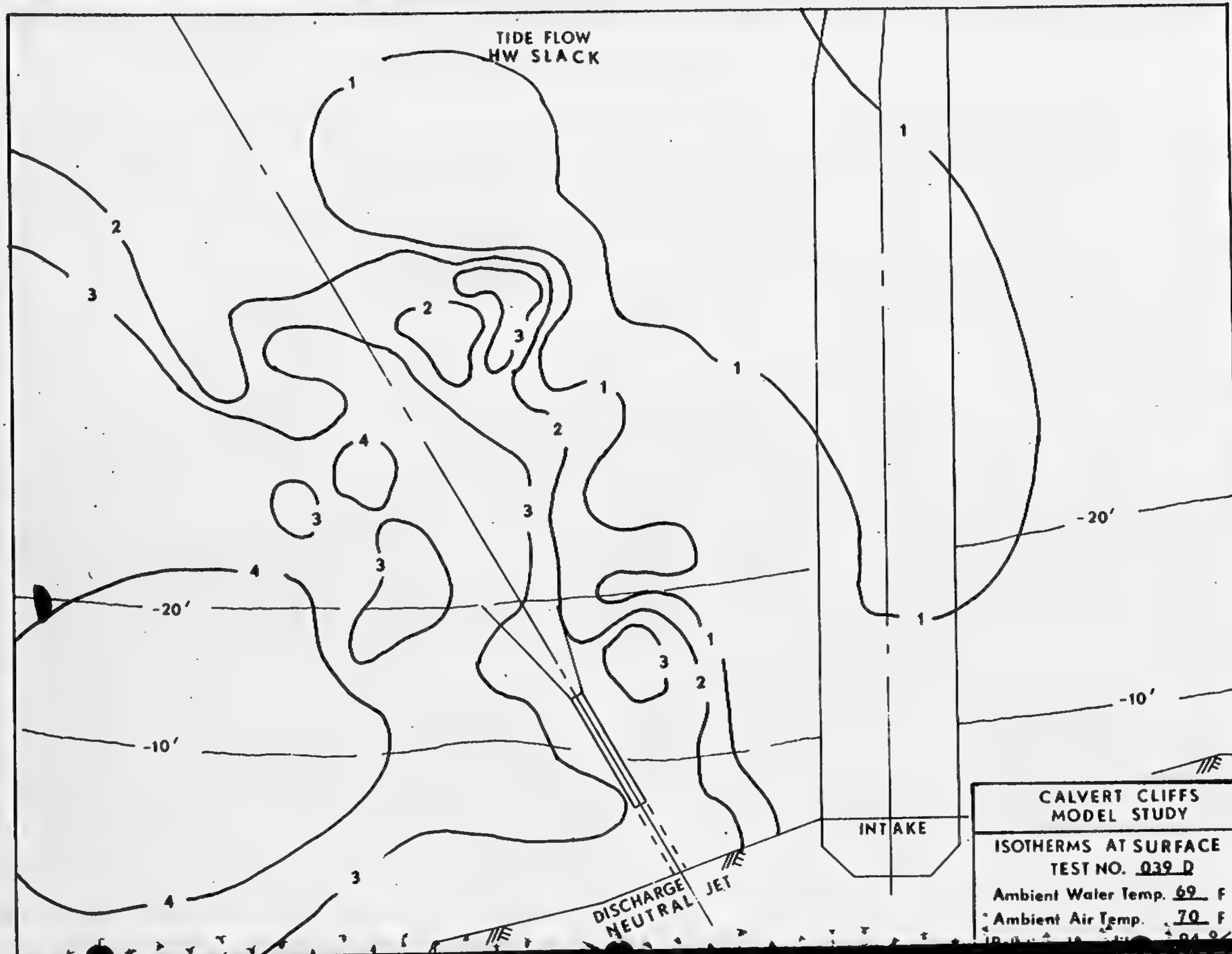

FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0 15 000 30,000
MAP SCALE IN FEET
TIDE FLOW
HOOPER ISLANDS
M D GRID N 1010000
M D GRID E 220,000
CHOPTANK RIVER
DOWNSTREAM
UPSTREAM
MD GRID N 960000
COVE POINT
PLANT SITE
HOLLAND POINT
N
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT SURFACE
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
MSL
-15'
-26'
-28'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION

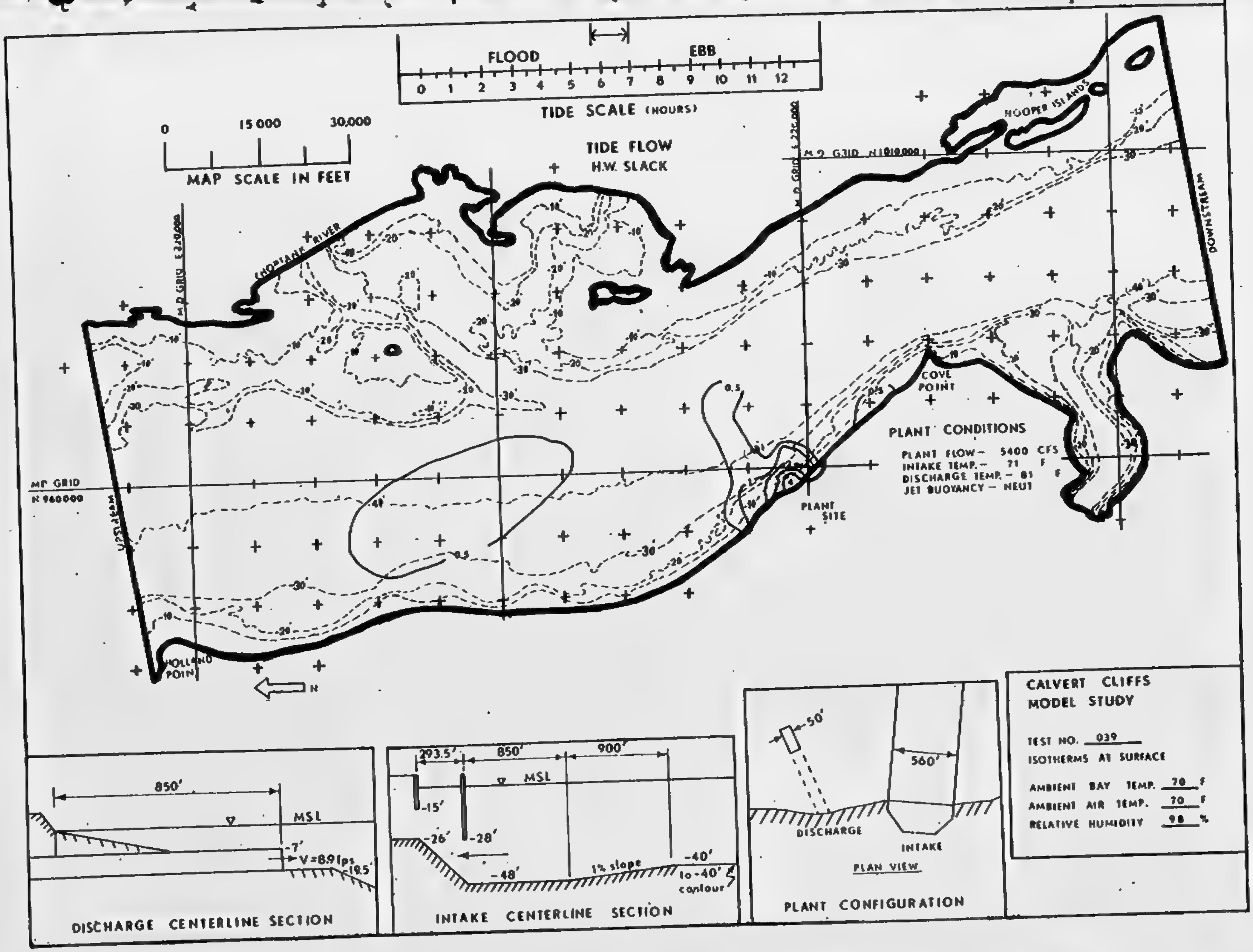

TIDE FLOW
1
2
3
4
-20'
-10'
INTAKE
DISCHARGE JET
NEUTRAL
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT 10' DEPTH
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F


FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0
15 000
30,000
MAP SCALE IN FEET
TIDE FLOW
HOOPER ISLANDS
CHOPTANK RIVER
COVE POINT
PLANT SITE
HOLLAND POINT
UPSTREAM
DOWNSTREAM
N
MD GRID N 960000
MD GRID N 1010000
MD GRID E 220,000
MD GRID E 320,000
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT 10' DEPTH
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
MSL
-15'
-26'
-28'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION

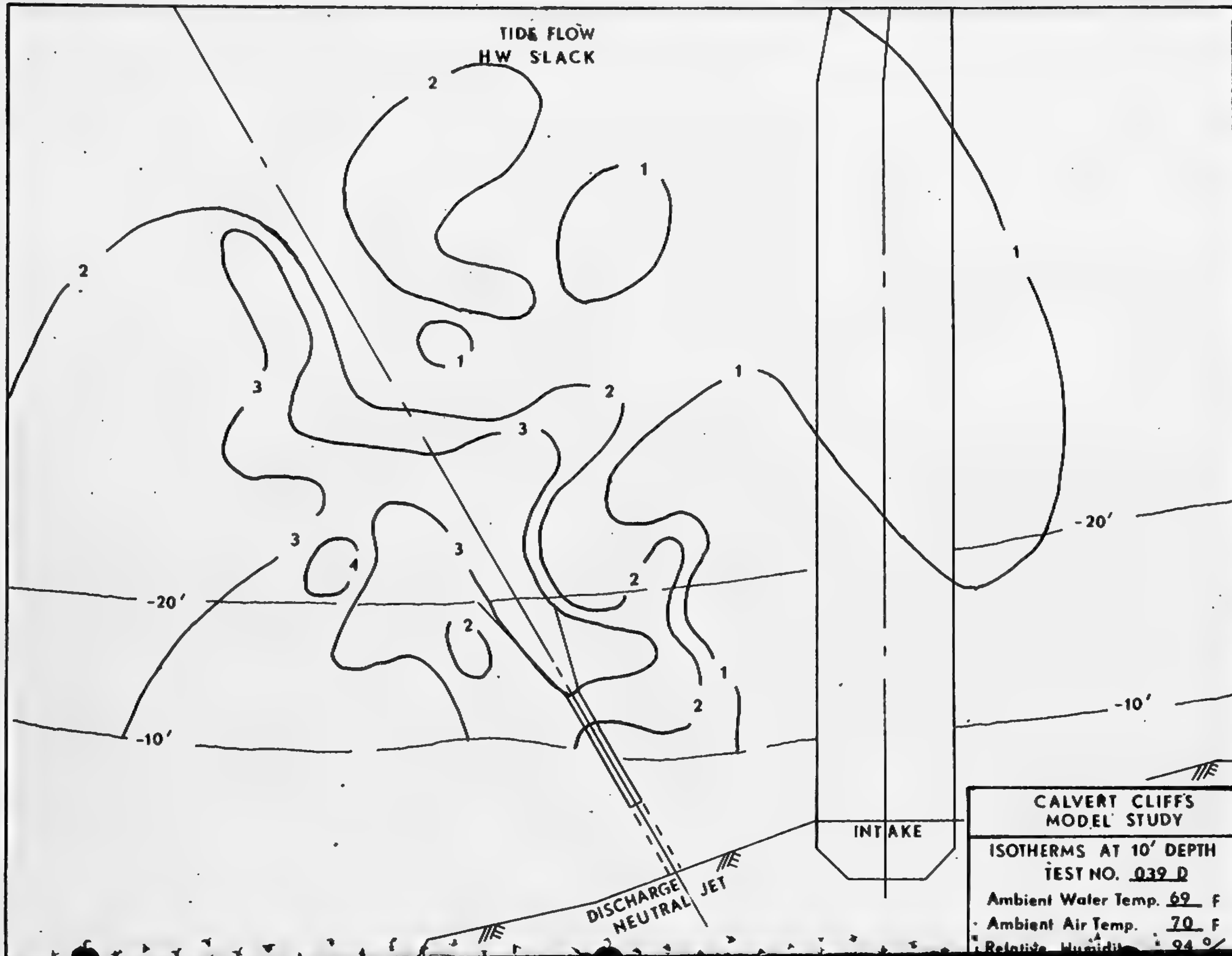

TIDE FLOW
1
2
3
2
4
1
1
1
2
3
3
2
-20′
-20′
-10′
-10′
INTAKE
DISCHARGE JET
NEUTRAL
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT 20′ DEPTH
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F
Relative Humidity 91 %

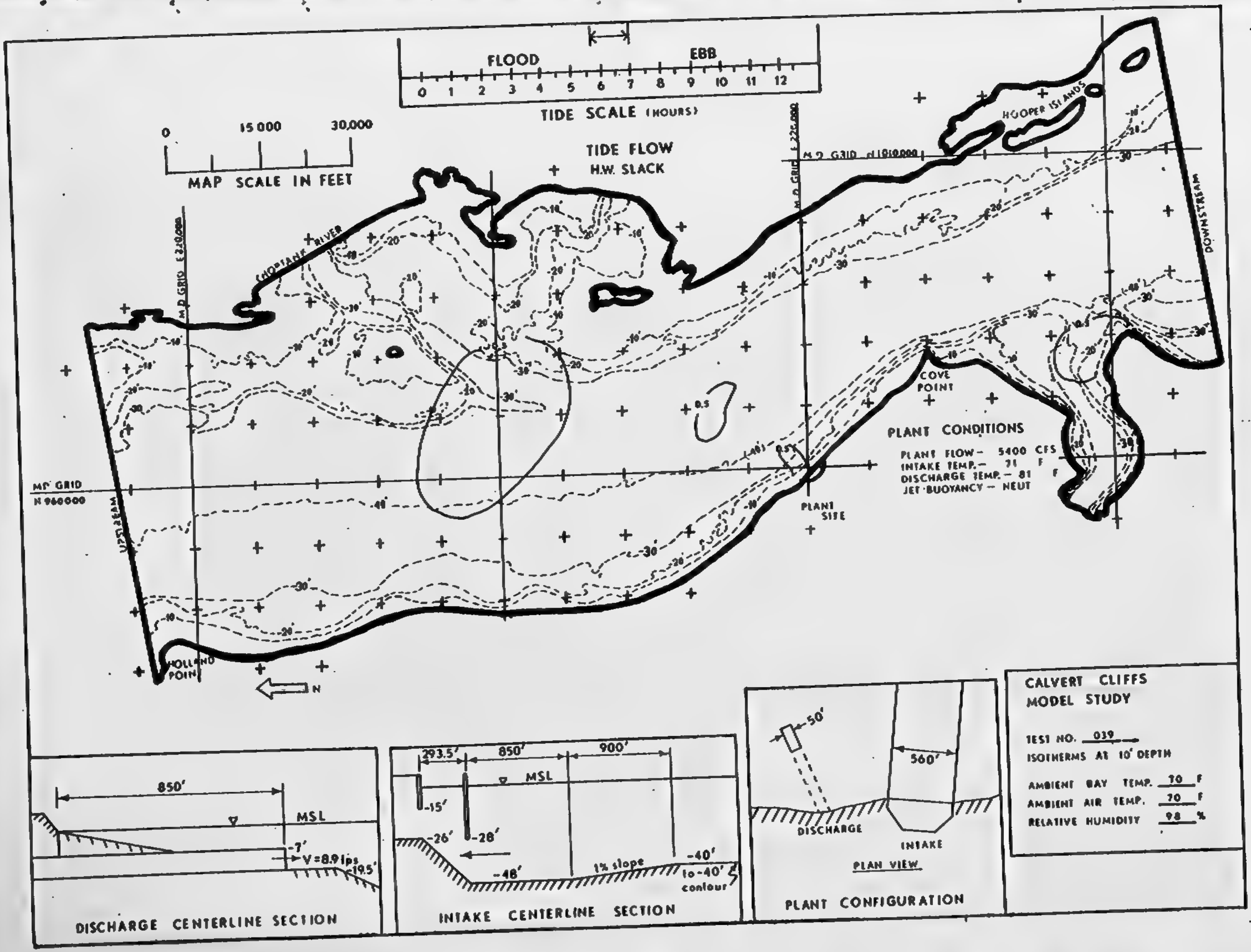

FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0
15 000
30,000
MAP SCALE IN FEET
TIDE FLOW
CHOPTANK RIVER
HOOPER ISLANDS
DOWNSTREAM
UPSTREAM
M D GRID N1010000
M D GRID E 220,000
M D GRID E 230,000
MD GRID
N 960000
COVE POINT
PLANT SITE
HOLLAND POINT
N
0.5
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT 20' DEPTH
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
MSL
-15'
-26'
-28'
-48'
1% slope
-40'
lo-40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION

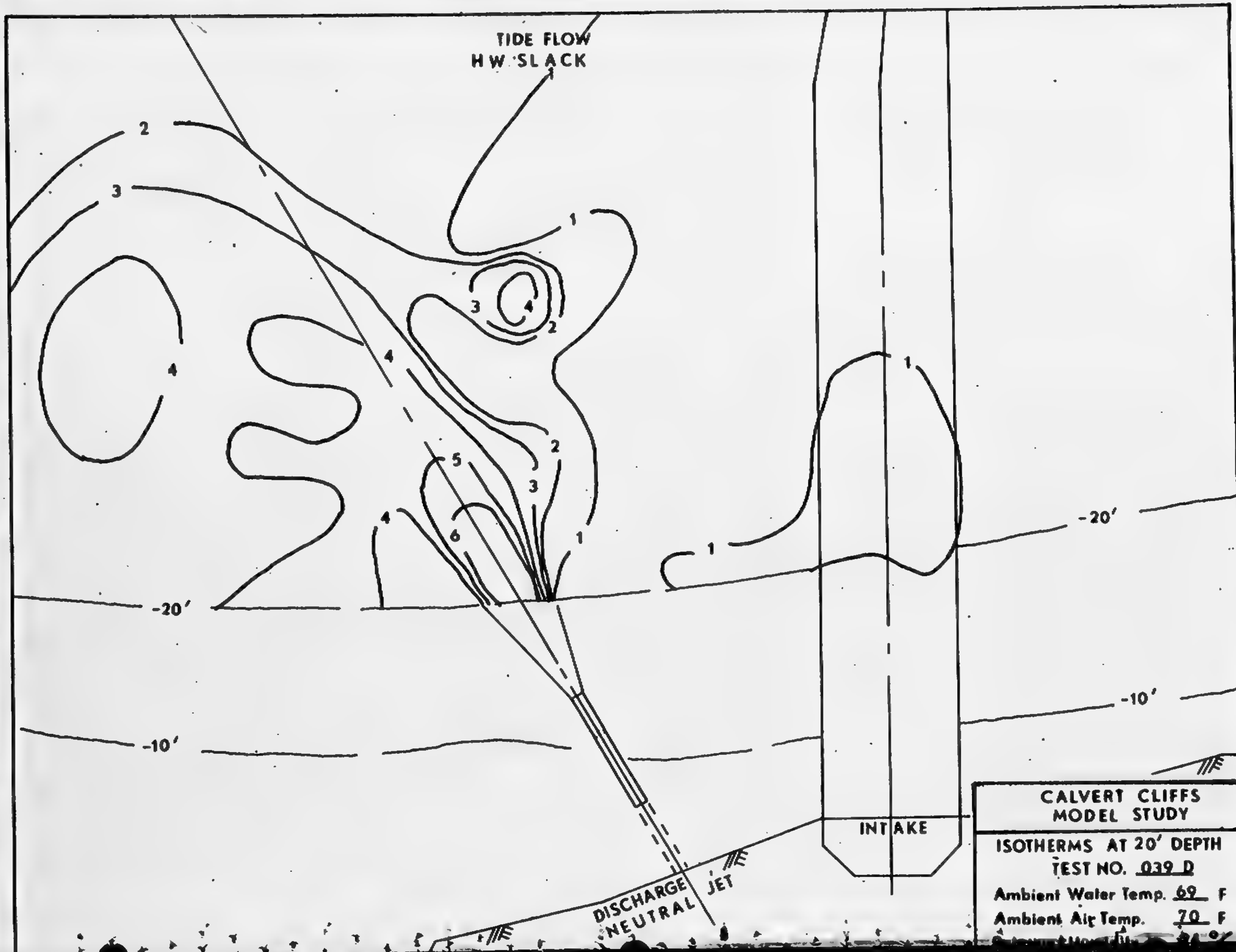

TIDE FLOW
HW SLACK
1
2
3
4
-20′
-10′
DISCHARGE JET
NEUTRAL
INTAKE
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT SURFACE
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F

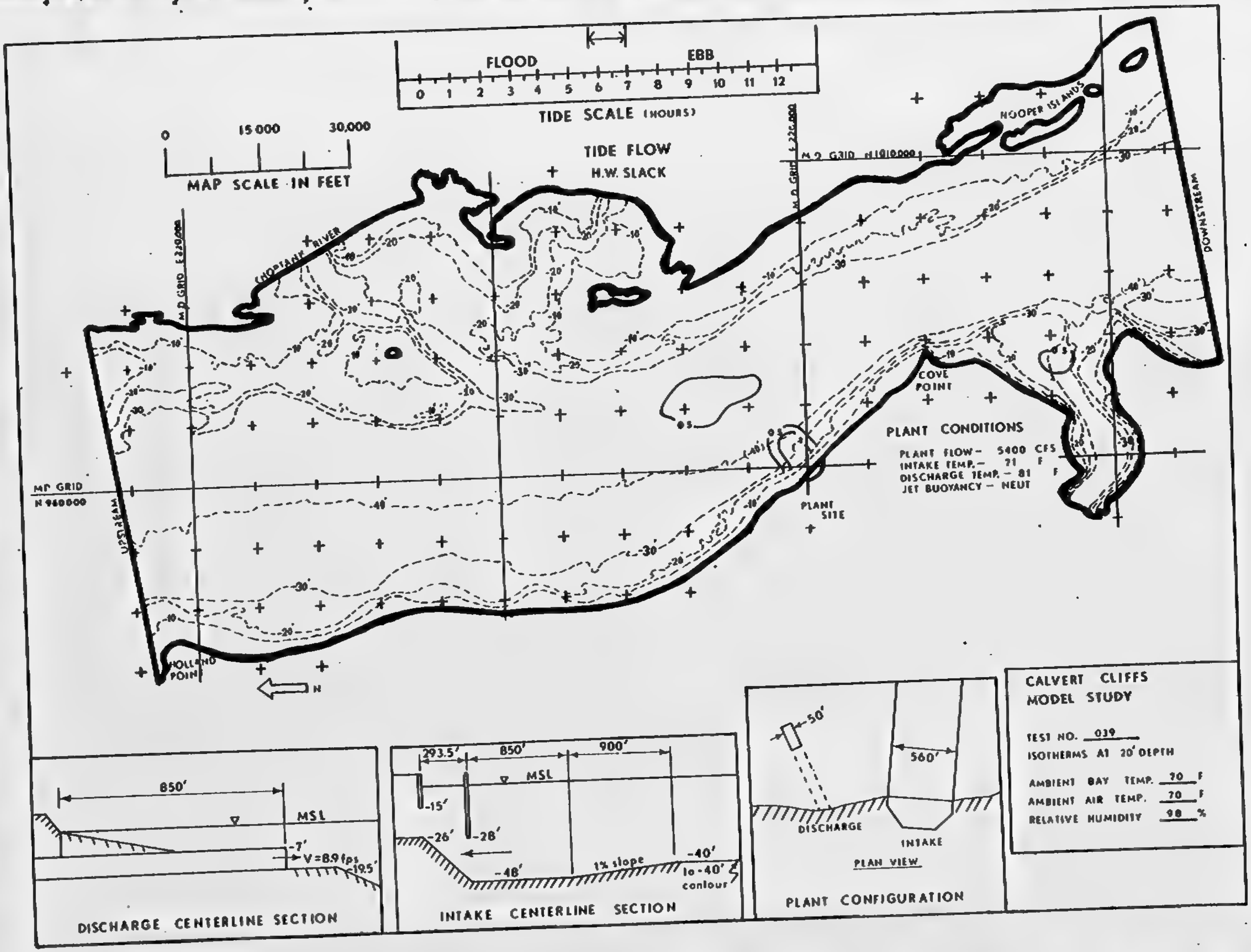


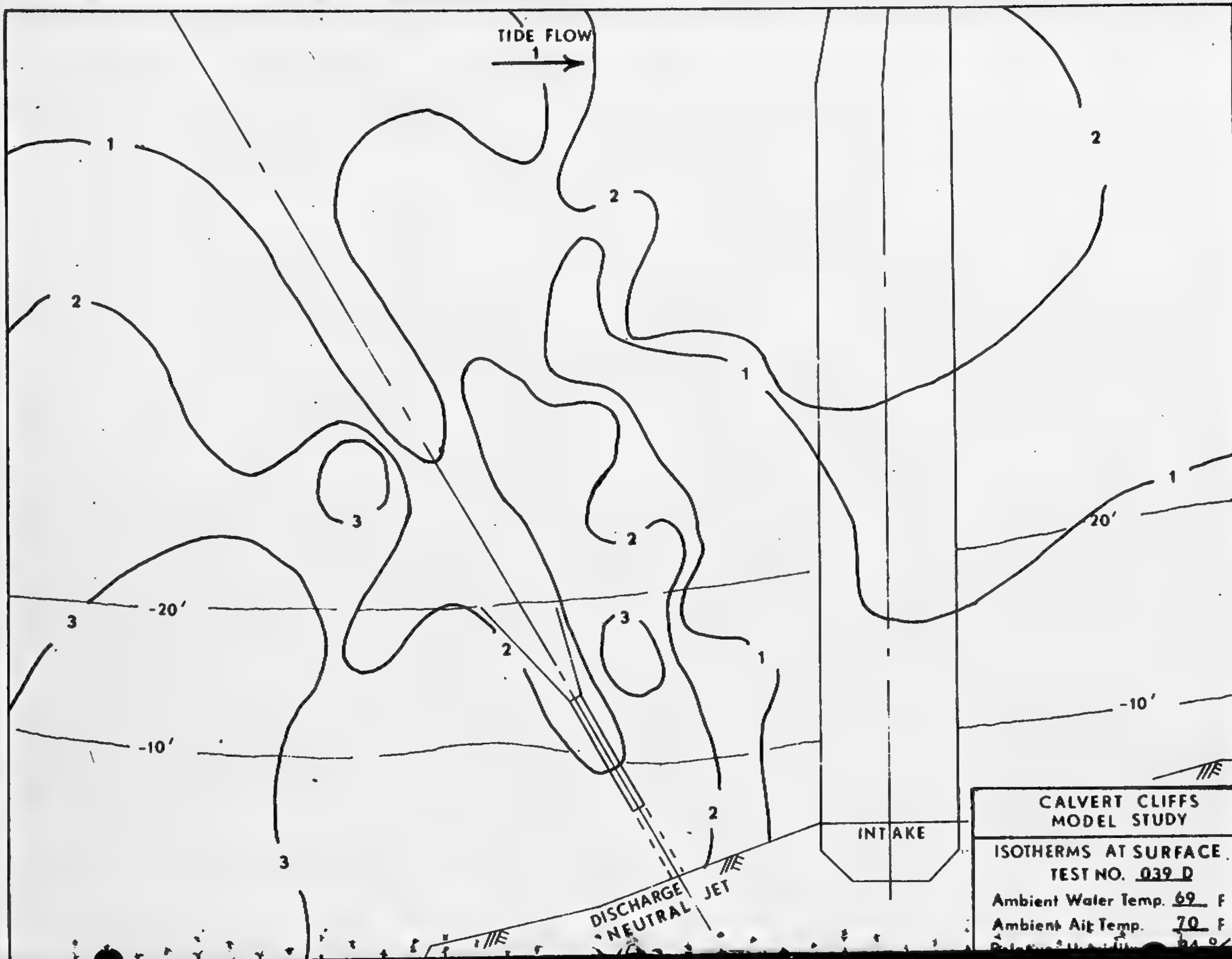
FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0 15 000 30,000
MAP SCALE IN FEET
TIDE FLOW
H.W. SLACK
HOOPER ISLANDS
CHOPTANK RIVER
DOWNSTREAM
UPSTREAM
COVE POINT
HOLLAND POINT
PLANT SITE
N
PLANT CONDITIONS
PLANT FLOW – 5400 CFS
INTAKE TEMP. – 71 F
DISCHARGE TEMP. – 81 F
JET BUOYANCY – NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT SURFACE
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
DISCHARGE CENTERLINE SECTION
INTAKE CENTERLINE SECTION
PLANT CONFIGURATION
PLAN VIEW
DISCHARGE
INTAKE


TIDE FLOW
HW SLACK
INTAKE
DISCHARGE JET
NEUTRAL
-20'
-10'
1
2
3
4
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT 10' DEPTH
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F
Relative Humidity 94 %

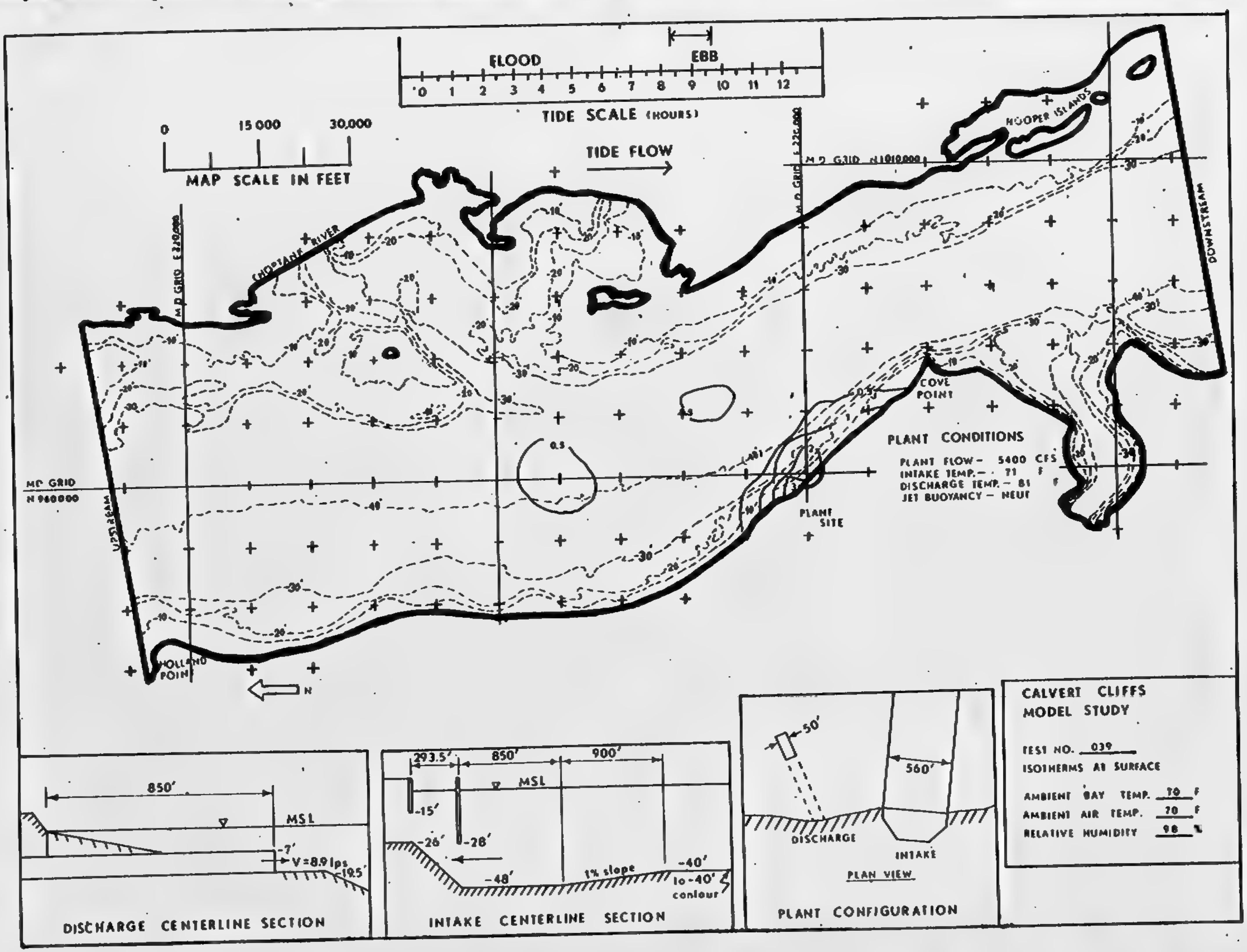

FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0
15 000
30,000
MAP SCALE IN FEET
TIDE FLOW
H.W. SLACK
HOOPER ISLANDS
DOWNSTREAM
UPSTREAM
COVE POINT
PLANT SITE
HOLLAND POINT
N
MD GRID N 960000
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
MSL
-15'
-26'
-28'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT 10' DEPTH
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %


TIDE FLOW
HW SLACK
1
2
3
4
5
6
-20'
-10'
INTAKE
DISCHARGE
NEUTRAL
JET
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT 20' DEPTH
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F

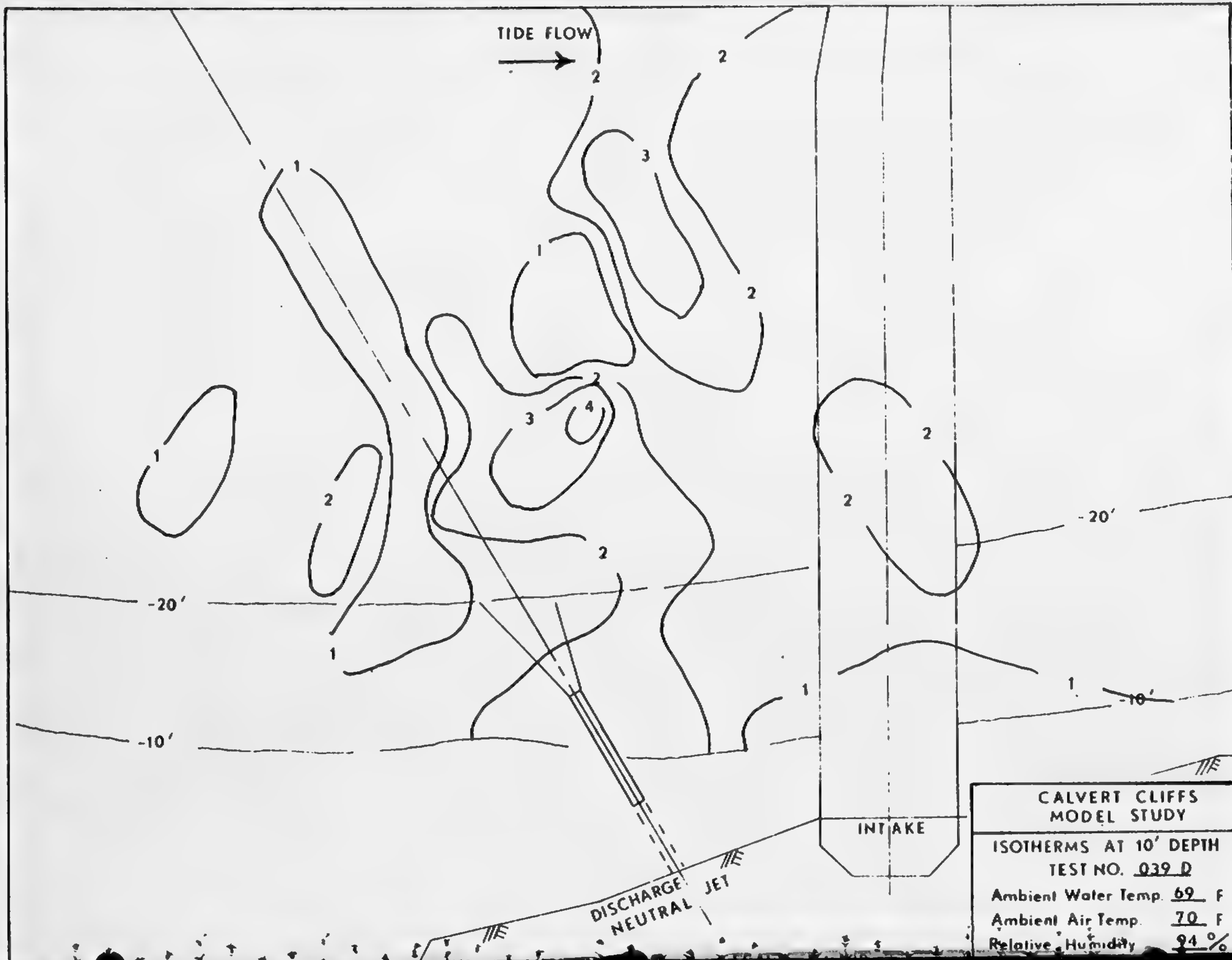

FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0 15 000 30,000
MAP SCALE IN FEET
TIDE FLOW
H.W. SLACK
HOOPER ISLANDS
CHOPTANK RIVER
M D GRID E 220,000
M D GRID E 226,000
M D GRID N 1010000
MD GRID N 960000
UPSTREAM
DOWNSTREAM
COVE POINT
PLANT SITE
HOLLAND POINT
N
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT 20' DEPTH
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
MSL
-15'
-26'
-28'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION

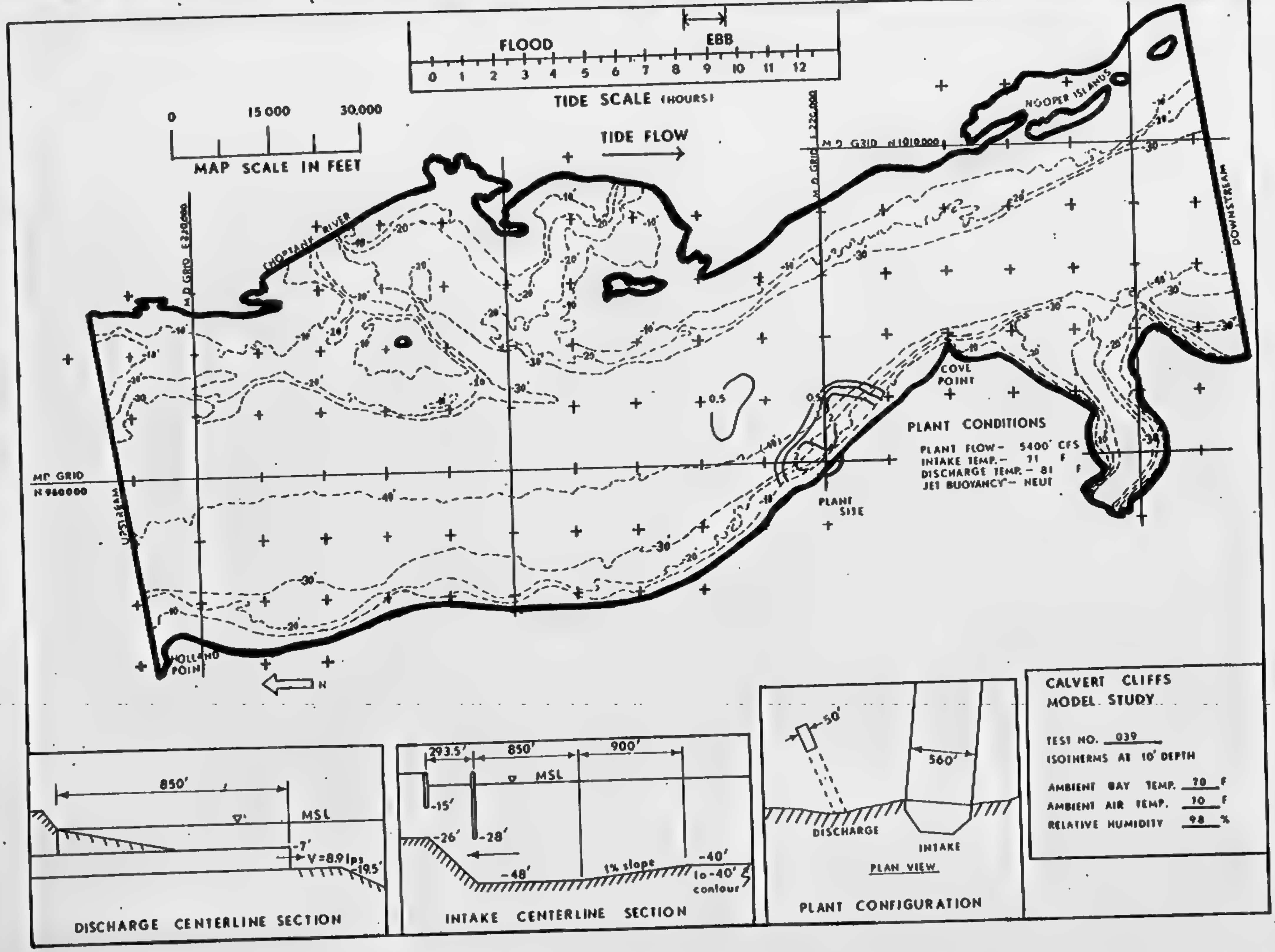


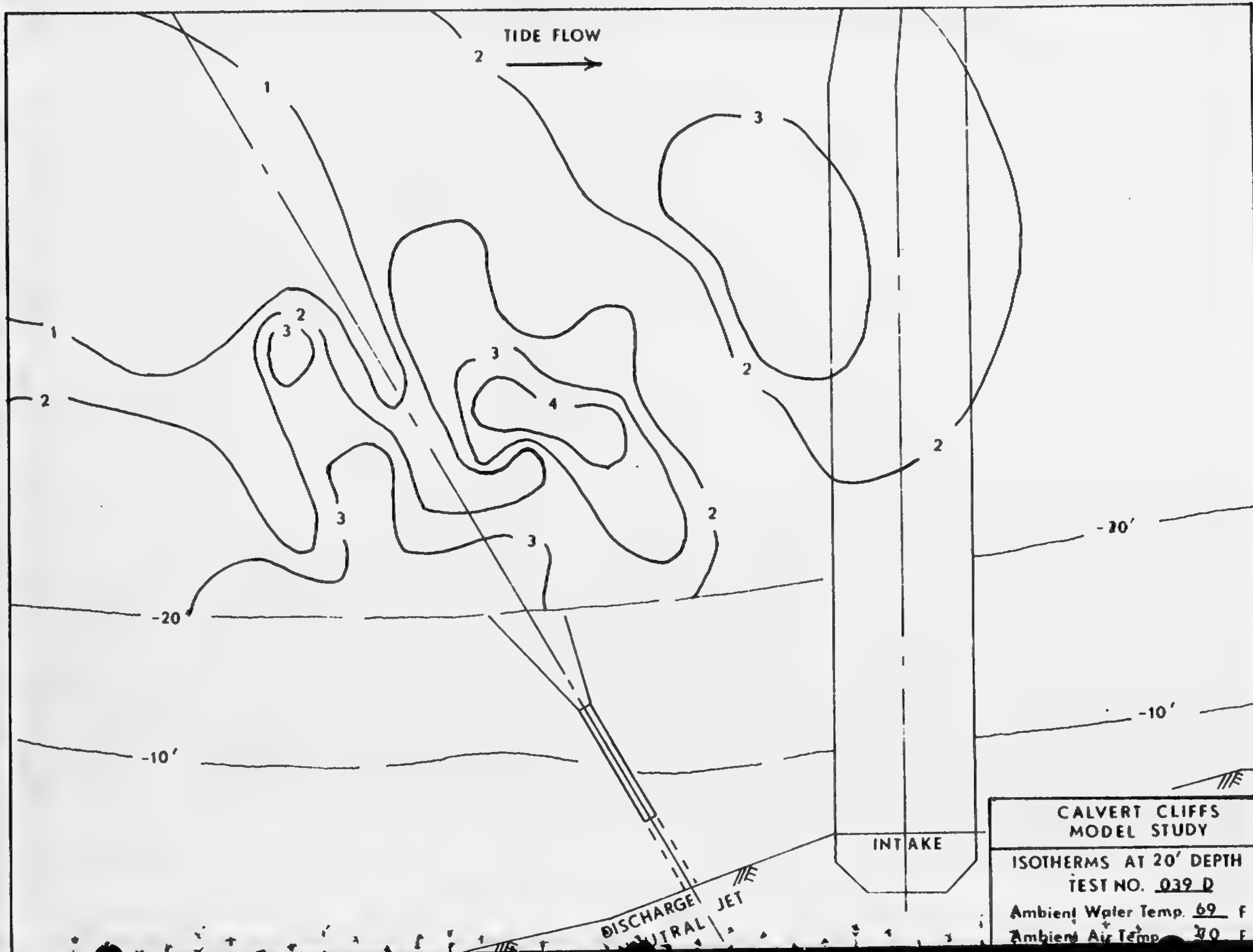
TIDE FLOW
1
2
3
-20'
-10'
INTAKE
DISCHARGE JET
NEUTRAL
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT SURFACE
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F

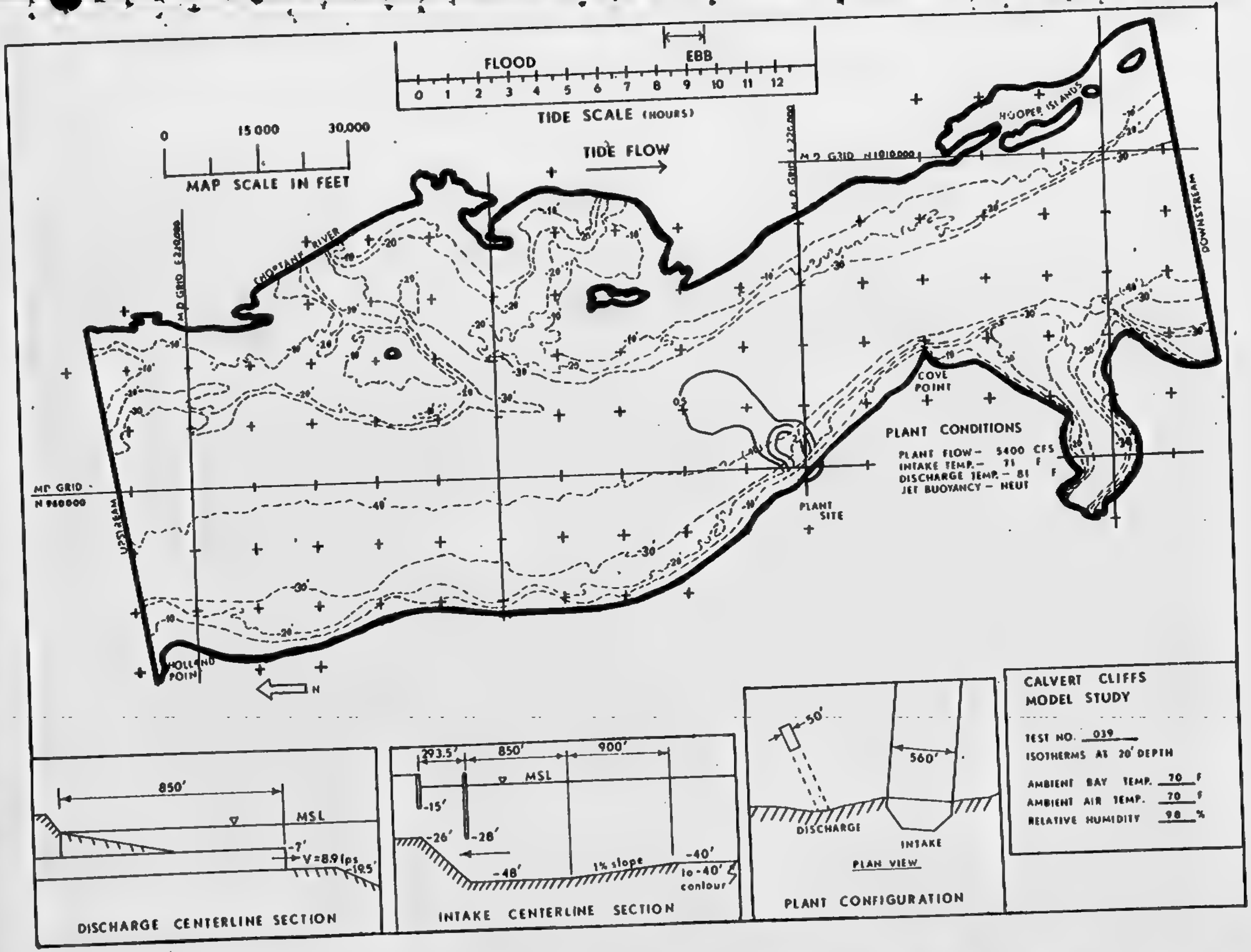


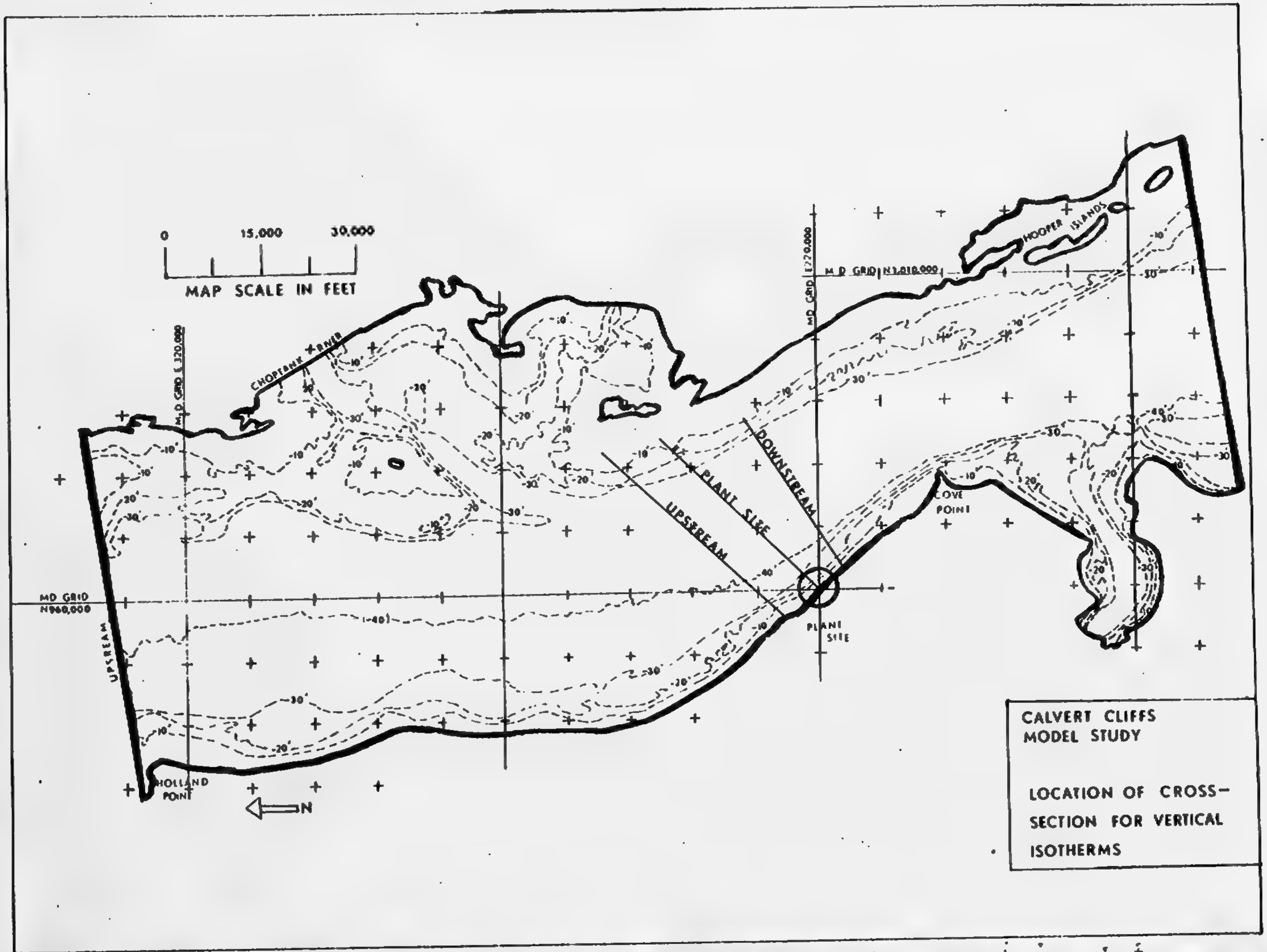
FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0
15 000
30,000
MAP SCALE IN FEET
TIDE FLOW
HOOPER ISLANDS
M D GRID N1010000
M D GRID E 225,000
M D GRID E 320,000
CHOPTANK RIVER
DOWNSTREAM
UPSTREAM
COVE POINT
PLANT SITE
HOLLAND POINT
MD GRID N 960000
N
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT SURFACE
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
850'
MSL
-7'
V=8.9 fps
19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
MSL
-15'
-26'
-28'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION


TIDE FLOW
1
2
3
4
-20'
-10'
INTAKE
DISCHARGE
NEUTRAL
JET
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT 10' DEPTH
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F
Relative Humidity 94 %


FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0
15 000
30,000
MAP SCALE IN FEET
TIDE FLOW
HOOPER ISLANDS
CHOPTANK RIVER
DOWNSTREAM
UPSTREAM
COVE POINT
PLANT SITE
HOLLAND POINT
M.D GRID N 1010000
MD GRID N 960000
N
PLANT CONDITIONS
PLANT FLOW - 5400 CFS
INTAKE TEMP. - 71 F
DISCHARGE TEMP. - 81 F
JET BUOYANCY - NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT 10' DEPTH
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
MSL
-15'
-26'
-28'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION

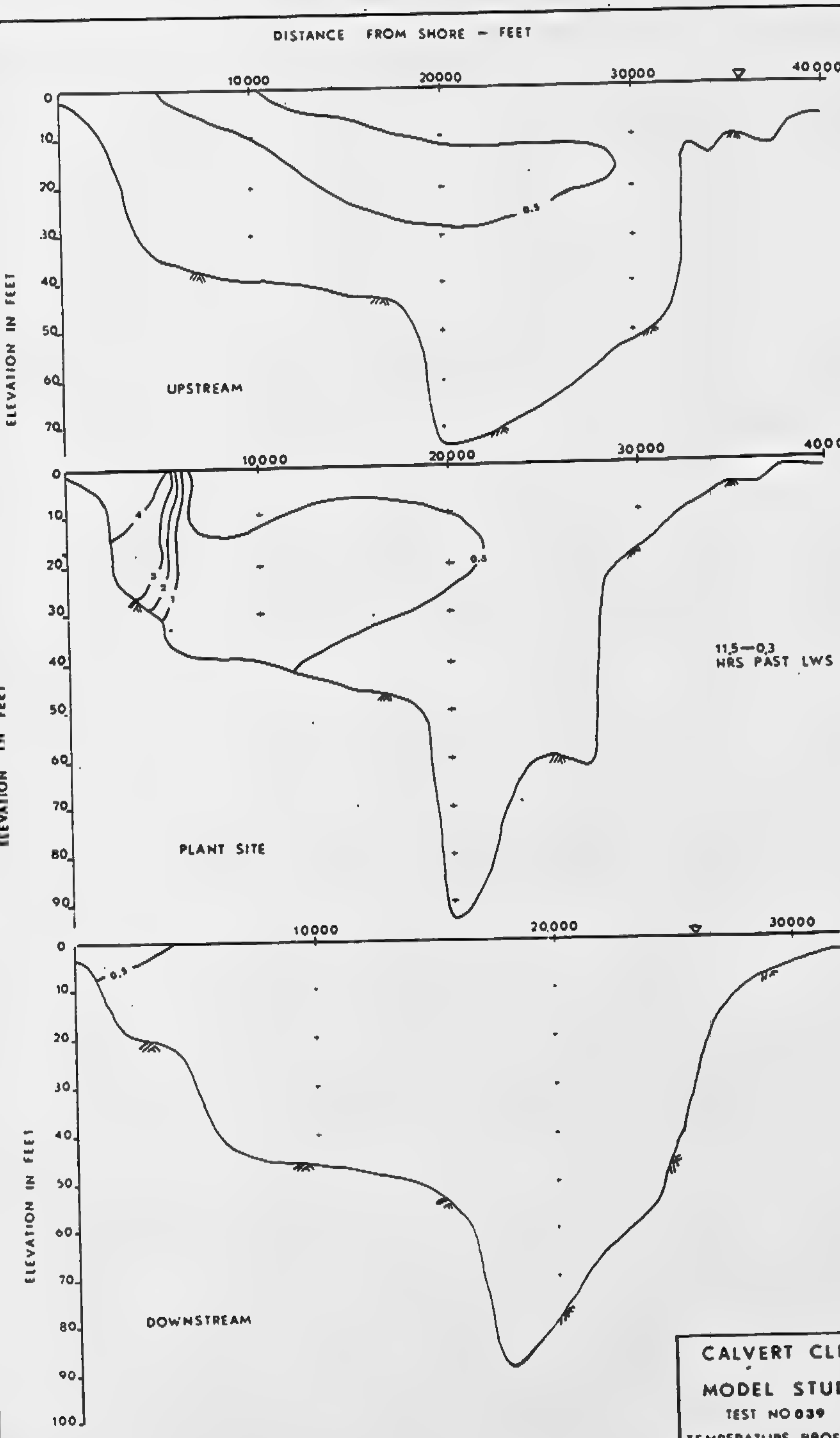

TIDE FLOW
1
2
3
4
-20'
-10'
INTAKE
DISCHARGE JET
NEUTRAL
CALVERT CLIFFS
MODEL STUDY
ISOTHERMS AT 20' DEPTH
TEST NO. 039 D
Ambient Water Temp. 69 F
Ambient Air Temp. 70 F


FLOOD
EBB
0 1 2 3 4 5 6 7 8 9 10 11 12
TIDE SCALE (HOURS)
0
15 000
30,000
MAP SCALE IN FEET
TIDE FLOW
HOOPER ISLANDS
CHOPTANK RIVER
DOWNSTREAM
UPSTREAM
COVE POINT
PLANT SITE
HOLLAND POINT
N
MD GRID N 960000
PLANT CONDITIONS
PLANT FLOW – 5400 CFS
INTAKE TEMP. – 71 F
DISCHARGE TEMP. – 81 F
JET BUOYANCY – NEUT
CALVERT CLIFFS
MODEL STUDY
TEST NO. 039
ISOTHERMS AT 20' DEPTH
AMBIENT BAY TEMP. 70 F
AMBIENT AIR TEMP. 70 F
RELATIVE HUMIDITY 98 %
850'
MSL
-7'
V=8.9 fps
-19.5'
DISCHARGE CENTERLINE SECTION
293.5'
850'
900'
-15'
-28'
-26'
-48'
1% slope
-40'
to -40' contour
INTAKE CENTERLINE SECTION
50'
560'
DISCHARGE
INTAKE
PLAN VIEW
PLANT CONFIGURATION



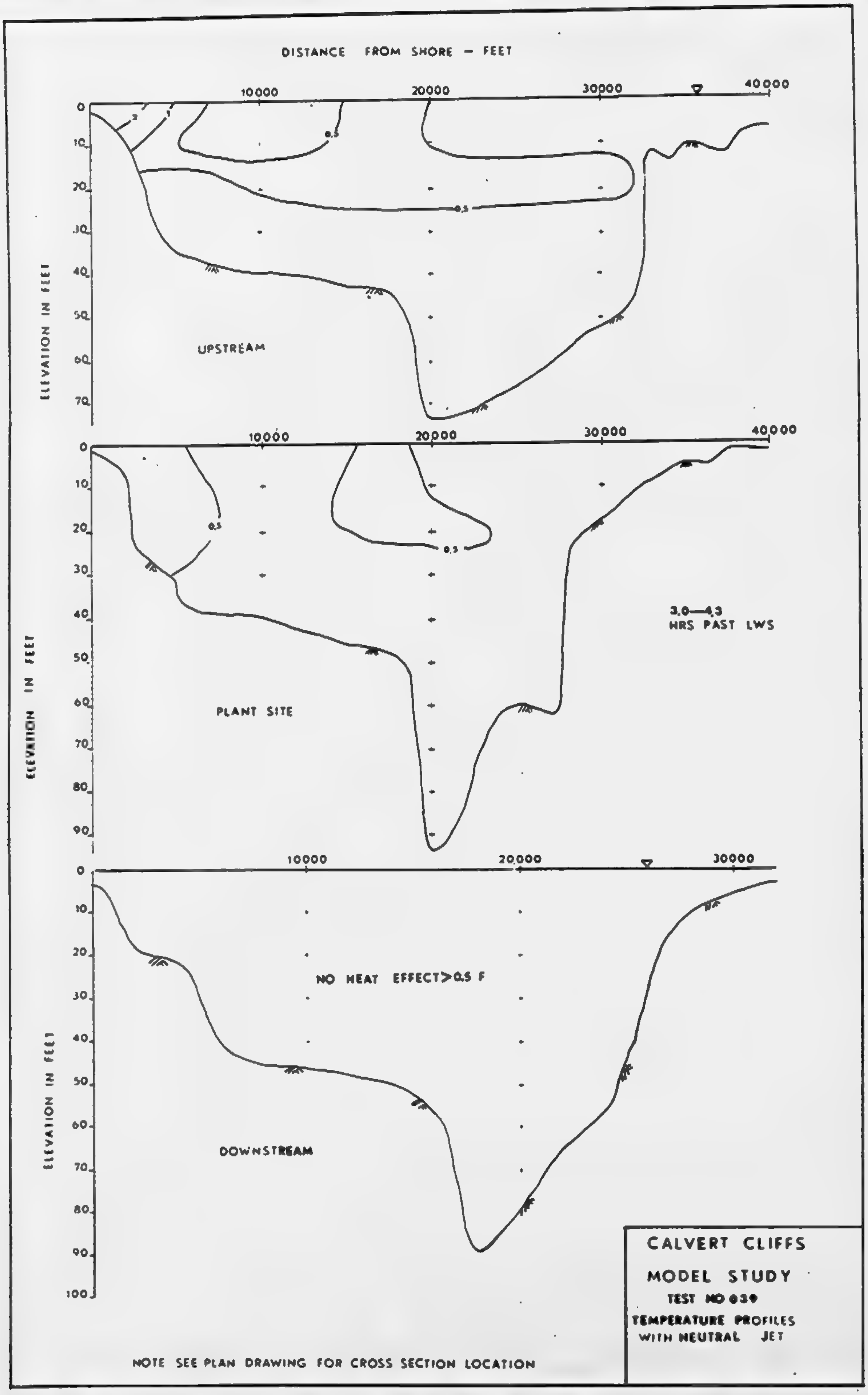
CALVERT CLIFFS
MODEL STUDY

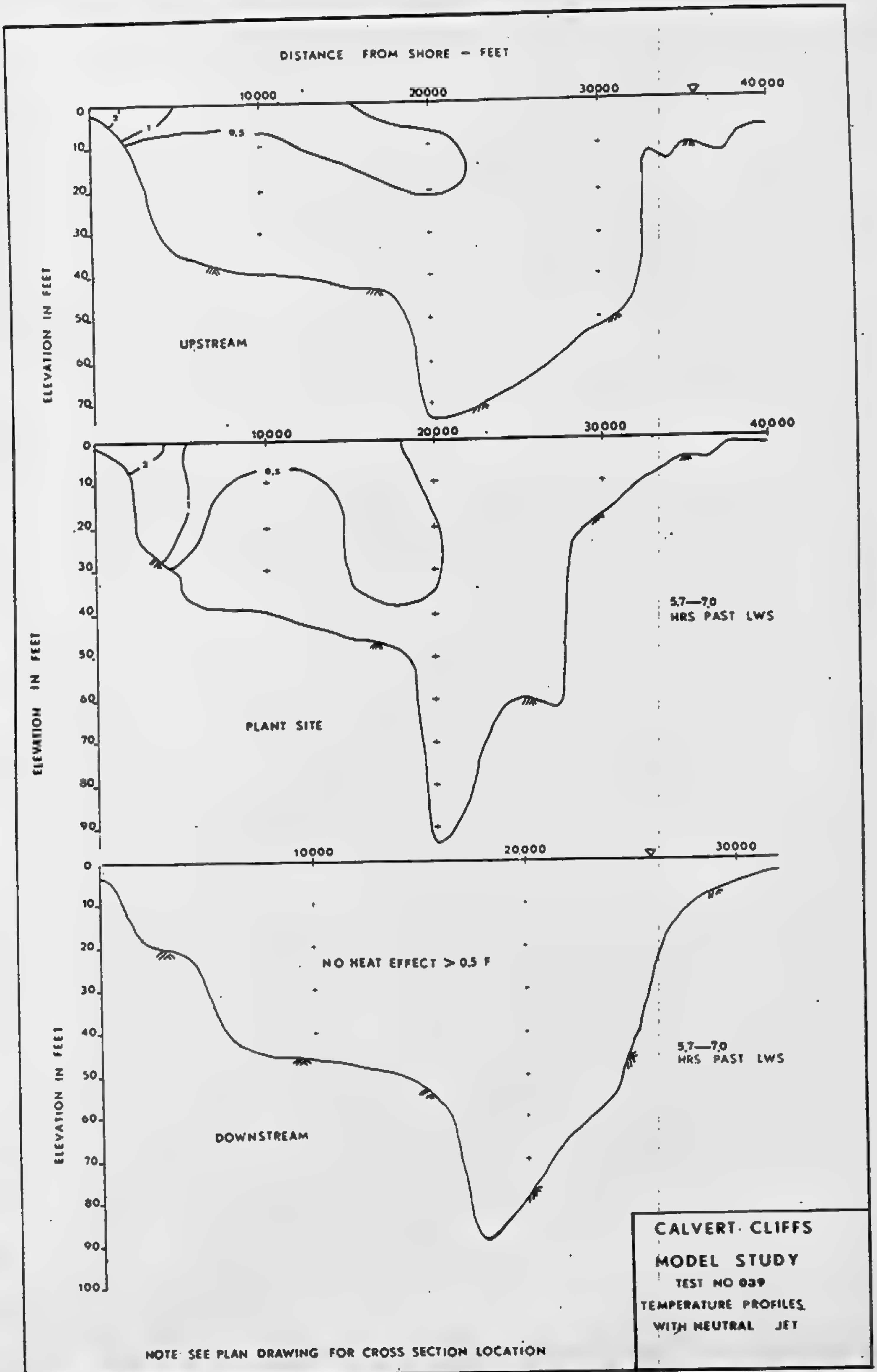
LOCATION OF CROSS-SECTION FOR VERTICAL ISOTHERMS

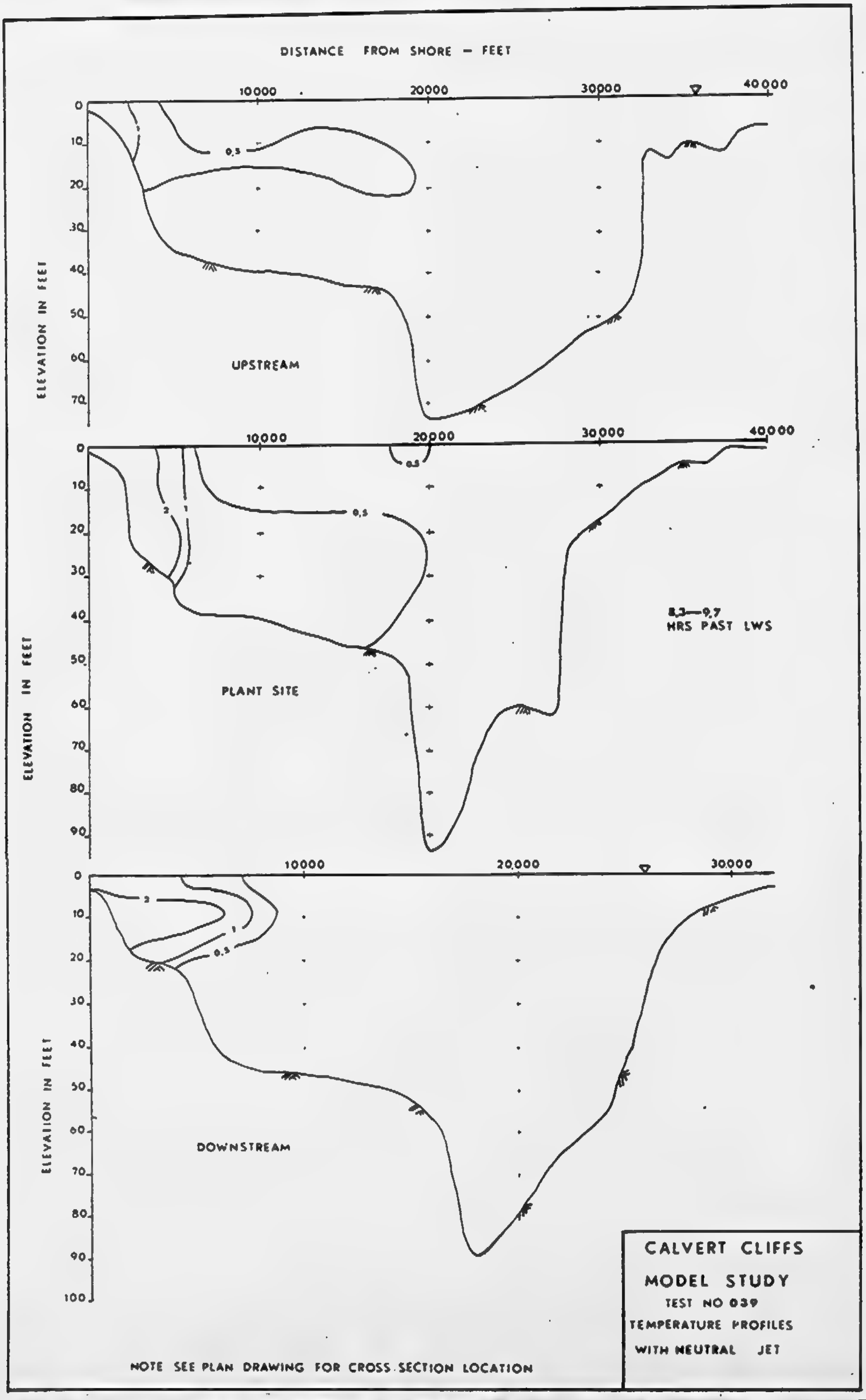


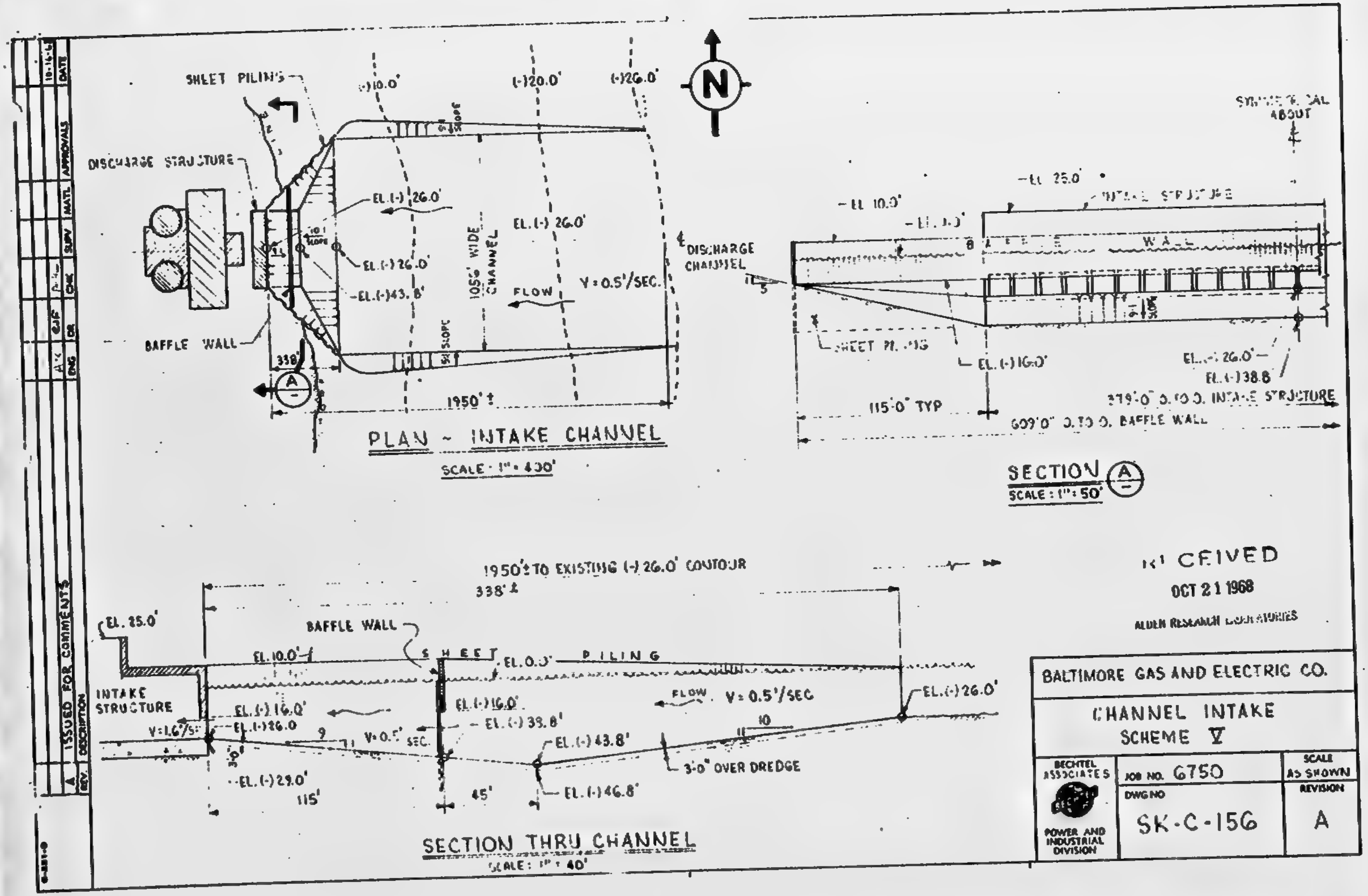
CALVERT CLIFFS
MODEL STUDY
TEST NO 039
TEMPERATURE PROFILES
WITH NEUTRAL JET

NOTE SEE PLAN DRAWING FOR CROSS SECTION LOCATION

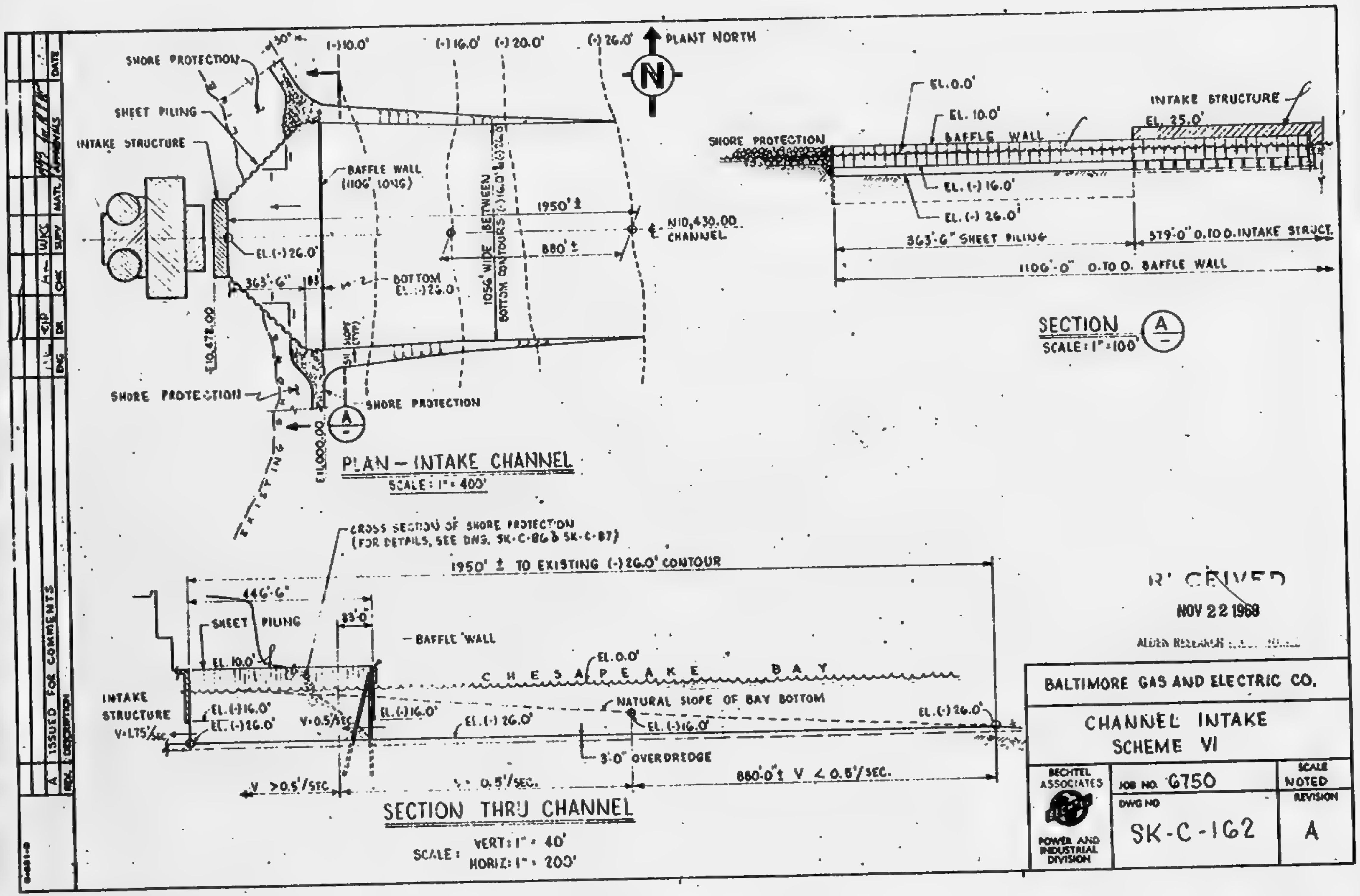

DISTANCE FROM SHORE — FEET
ELEVATION IN FEET
UPSTREAM
PLANT SITE
3.0—4.3
HRS PAST LWS
NO HEAT EFFECT>0.5 F
DOWNSTREAM
CALVERT CLIFFS
MODEL STUDY
TEST NO 039
TEMPERATURE PROFILES
WITH NEUTRAL JET
NOTE SEE PLAN DRAWING FOR CROSS SECTION LOCATION

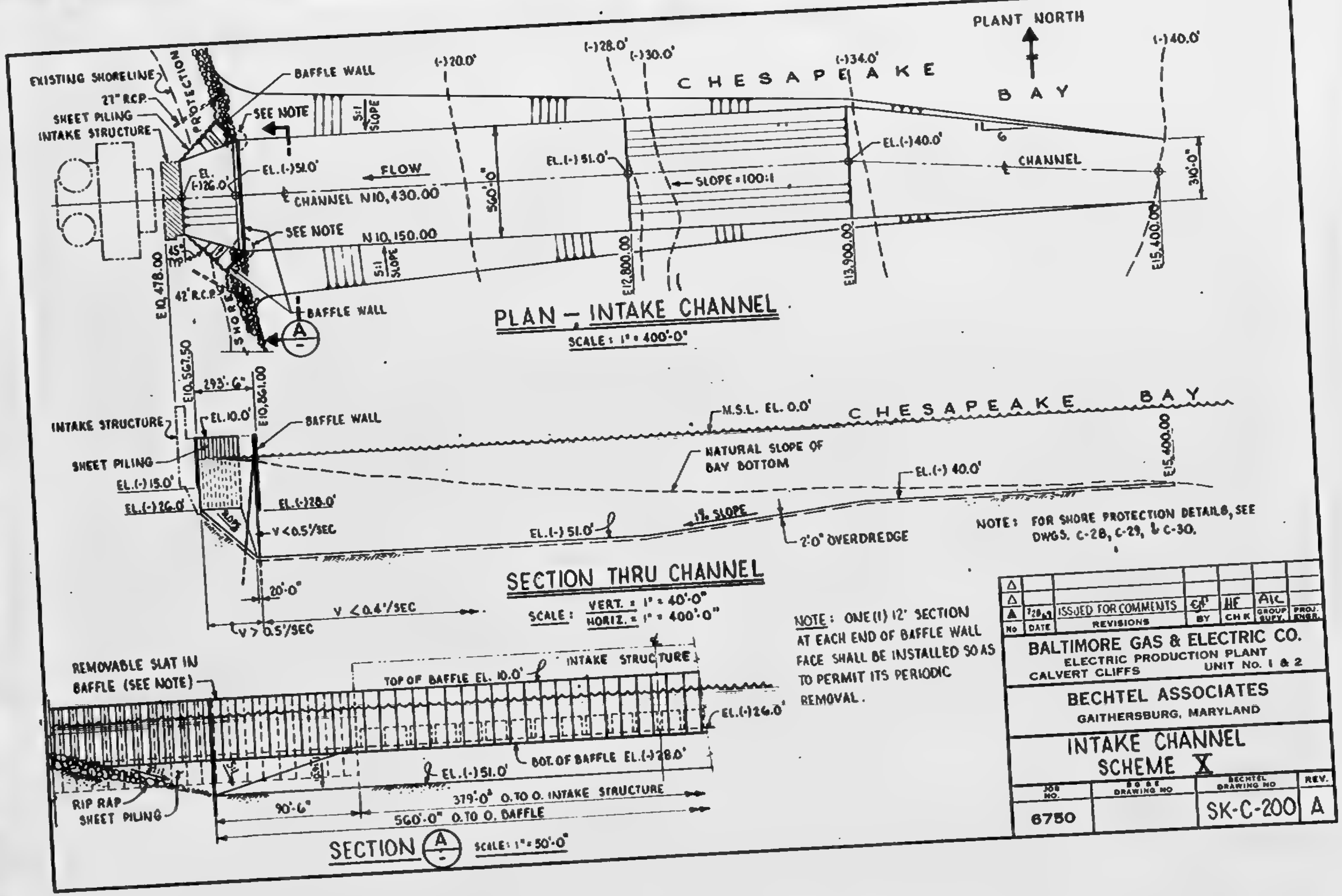

DISTANCE FROM SHORE — FEET
10000
20000
30000
40000
ELEVATION IN FEET
0
10
20
30
40
50
60
70
2
1
0.5
UPSTREAM
10000
20000
30000
40000
ELEVATION IN FEET
0
10
20
30
40
50
60
70
80
90
2
1
0.5
PLANT SITE
5.7—7.0
HRS PAST LWS
10000
20000
30000
ELEVATION IN FEET
0
10
20
30
40
50
60
70
80
90
100
NO HEAT EFFECT > 0.5 F
DOWNSTREAM
5.7—7.0
HRS PAST LWS
CALVERT CLIFFS
MODEL STUDY
TEST NO 039
TEMPERATURE PROFILES
WITH NEUTRAL JET
NOTE: SEE PLAN DRAWING FOR CROSS SECTION LOCATION

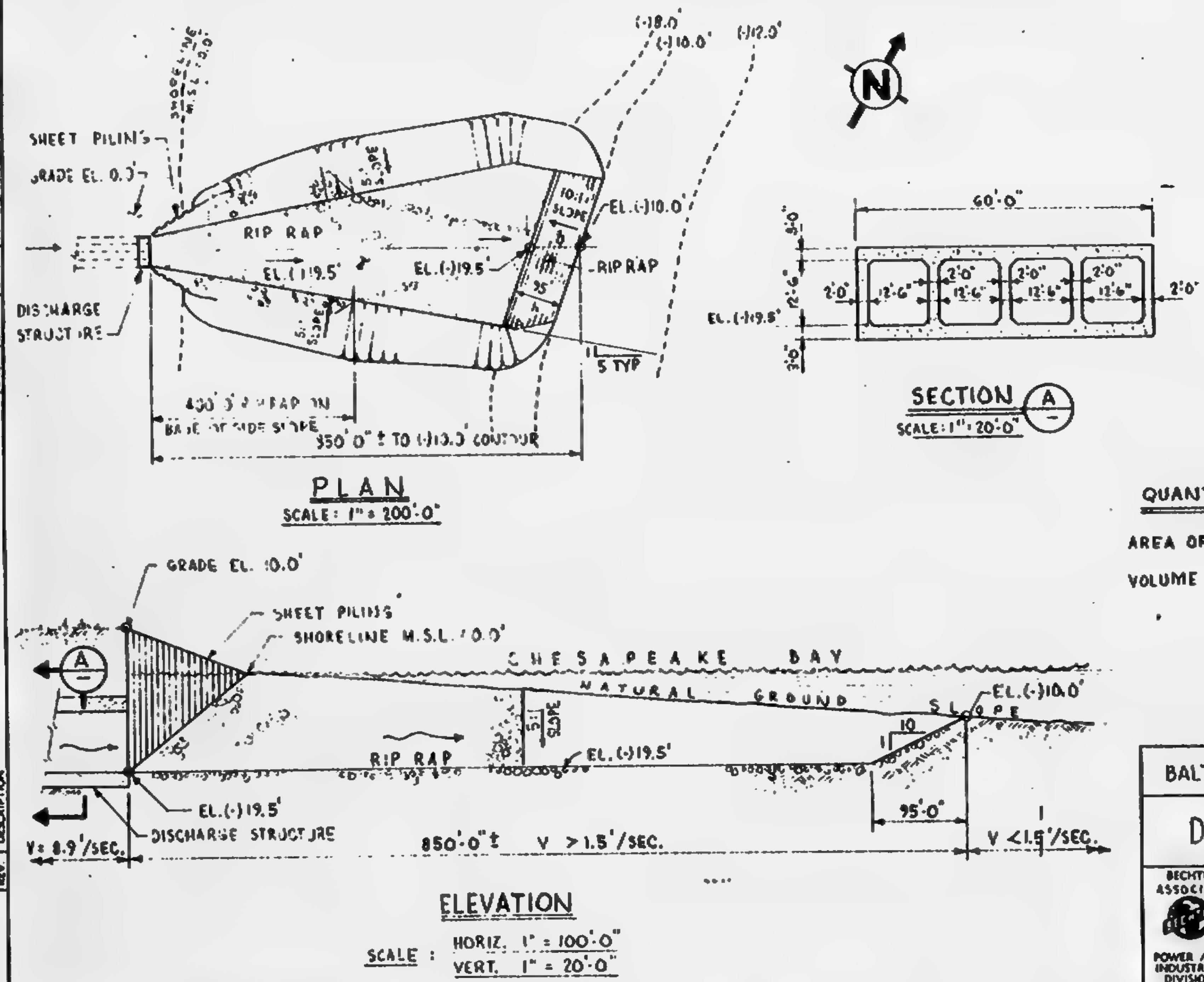

DISTANCE FROM SHORE — FEET
10000
20000
30000
40000
ELEVATION IN FEET
0.5
UPSTREAM
10,000
20,000
30,000
40,000
2
1
0.5
8.3—9.7
HRS PAST LWS
PLANT SITE
10000
20,000
30,000
DOWNSTREAM
CALVERT CLIFFS
MODEL STUDY
TEST NO 039
TEMPERATURE PROFILES
WITH NEUTRAL JET
NOTE SEE PLAN DRAWING FOR CROSS SECTION LOCATION



PLAN ~ INTAKE CHANNEL
SCALE: 1" = 400'
SHEET PILINGS
DISCHARGE STRUCTURE
BAFFLE WALL
EL.(-) 26.0'
EL.(-) 43.8'
105' WIDE CHANNEL
FLOW
V = 0.5'/SEC.
1950' ±
338'
DISCHARGE CHANNEL
SECTION A
SCALE: 1" = 50'
EL 25.0'
EL 10.0'
INTAKE STRUCTURE
WALL
SHEET PILING
EL.(-) 16.0'
EL.(-) 26.0'
EL.(-) 38.8
115'-0" TYP
379'-0" O. TO O. INTAKE STRUCTURE
609'-0" O. TO O. BAFFLE WALL
SYMMETRICAL ABOUT
SECTION THRU CHANNEL
SCALE: 1" = 40'
1950' ± TO EXISTING (-) 26.0' CONTOUR
338' ±
EL. 25.0'
BAFFLE WALL
EL. 10.0'
SHEET PILING
EL. 0.0'
INTAKE STRUCTURE
V = 1.6'/SEC
EL.(-) 16.0'
EL.(-) 26.0
EL.(-) 29.0'
V = 0.5'/SEC.
EL.(-) 33.8'
EL.(-) 43.8'
EL.(-) 46.8'
FLOW
V = 0.5'/SEC
EL.(-) 26.0'
3'-0" OVER DREDGE
115'
45'
RECEIVED
OCT 21 1968
ALDEN RESEARCH LABORATORIES
BALTIMORE GAS AND ELECTRIC CO.
CHANNEL INTAKE
SCHEME V
BECHTEL ASSOCIATES
POWER AND INDUSTRIAL DIVISION
JOB NO. 6750
SCALE AS SHOWN
DWG NO SK-C-156
REVISION A
REV. | DESCRIPTION
A | ISSUED FOR COMMENTS
DATE 10-16-68


PLANT NORTH
SHORE PROTECTION
SHEET PILING
INTAKE STRUCTURE
BAFFLE WALL (1106' LONG)
(-)10.0'
(-)16.0'
(-)20.0'
(-)26.0'
1950' ±
880' ±
N10,430.00 CHANNEL
1056' WIDE BETWEEN BOTTOM CONTOURS (-)16.0' & (-)26.0'
EL.(-)26.0'
363'-6"
BOTTOM EL.(-)26.0
E10,478.00
E11,000.00
PLAN – INTAKE CHANNEL
SCALE: 1" = 400'
EL. 0.0'
EL. 10.0'
BAFFLE WALL
INTAKE STRUCTURE
EL. 25.0'
EL. (-) 16.0'
EL. (-) 26.0'
363'-6" SHEET PILING
379'-0" O.TO O. INTAKE STRUCT.
1106'-0" O.TO O. BAFFLE WALL
SECTION A
SCALE: 1" = 100'
CROSS SECTION OF SHORE PROTECTION (FOR DETAILS, SEE DWG. SK-C-86 & SK-C-87)
1950' ± TO EXISTING (-)26.0' CONTOUR
446'-6"
83'-0"
SHEET PILING
BAFFLE WALL
EL. 10.0'
EL. 0.0'
CHESAPEAKE BAY
NATURAL SLOPE OF BAY BOTTOM
INTAKE STRUCTURE V=1.75'/SEC.
EL.(-)16.0'
EL.(-)26.0'
V=0.5'/SEC.
EL.(-)16.0'
EL.(-) 26.0'
EL.(-)16.0'
EL.(-)26.0'
3'-0" OVERDREDGE
V >0.5'/SEC.
0.5'/SEC.
880'-0" ± V < 0.5'/SEC.
SECTION THRU CHANNEL
SCALE: VERT: 1" = 40' HORIZ: 1" = 200'
RECEIVED
NOV 22 1968
ALDEN RESEARCH
BALTIMORE GAS AND ELECTRIC CO.
CHANNEL INTAKE
SCHEME VI
BECHTEL ASSOCIATES
POWER AND INDUSTRIAL DIVISION
JOB NO. 6750
DWG NO SK-C-162
SCALE NOTED
REVISION A
A ISSUED FOR COMMENTS
REV. DESCRIPTION
ENG DR CHK SUPV MATL APPROVALS DATE


PLANT NORTH
CHESAPEAKE BAY
EXISTING SHORELINE
21" R.C.P.
SHEET PILING
INTAKE STRUCTURE
PROTECTION
SHORE
BAFFLE WALL
SEE NOTE
5:1 SLOPE
EL.(-)51.0'
EL.(-)26.0'
FLOW
CHANNEL N10,430.00
N10,150.00
45° TYP.
42" R.C.P.
E10,478.00
(-)20.0'
(-)28.0'
(-)30.0'
(-)34.0'
(-)40.0'
560'-0"
EL.(-)51.0'
SLOPE = 100:1
EL.(-)40.0'
CHANNEL
310'-0"
E12,800.00
E13,900.00
E15,400.00
PLAN – INTAKE CHANNEL
SCALE: 1" = 400'-0"
E10,567.50
293'-6"
E10,861.00
INTAKE STRUCTURE
EL.10.0'
BAFFLE WALL
SHEET PILING
EL.(-)15.0'
EL.(-)26.0'
EL.(-)28.0'
V < 0.5'/SEC
M.S.L. EL. 0.0'
CHESAPEAKE BAY
NATURAL SLOPE OF BAY BOTTOM
EL.(-) 40.0'
EL.(-) 51.0'
1% SLOPE
2'-0" OVERDREDGE
20'-0"
V < 0.4'/SEC
V > 0.5'/SEC
NOTE: FOR SHORE PROTECTION DETAILS, SEE DWGS. C-28, C-29, & C-30.
SECTION THRU CHANNEL
SCALE: VERT. = 1" = 40'-0" HORIZ. = 1" = 400'-0"
NOTE: ONE (1) 12' SECTION AT EACH END OF BAFFLE WALL FACE SHALL BE INSTALLED SO AS TO PERMIT ITS PERIODIC REMOVAL.
REMOVABLE SLAT IN BAFFLE (SEE NOTE)
TOP OF BAFFLE EL. 10.0'
INTAKE STRUCTURE
EL.(-)26.0'
BOT. OF BAFFLE EL.(-)28.0'
EL.(-)51.0'
RIP RAP
SHEET PILING
90'-6"
379'-0" O. TO O. INTAKE STRUCTURE
560'-0" O. TO O. BAFFLE
SECTION A
SCALE: 1" = 50'-0"
A 7-28-? ISSUED FOR COMMENTS HF AIC
NO DATE REVISIONS BY CHK GROUP SUPV. PROJ. ENGR.
BALTIMORE GAS & ELECTRIC CO.
ELECTRIC PRODUCTION PLANT
CALVERT CLIFFS UNIT No. 1 & 2
BECHTEL ASSOCIATES
GAITHERSBURG, MARYLAND
INTAKE CHANNEL
SCHEME X
JOB NO. 6750
BG&E DRAWING NO
BECHTEL DRAWING NO SK-C-200
REV. A



QUANTITIES:

AREA OF RIP RAP = ________ YD^2

VOLUME OF EXCAVATION = ________ YD^3

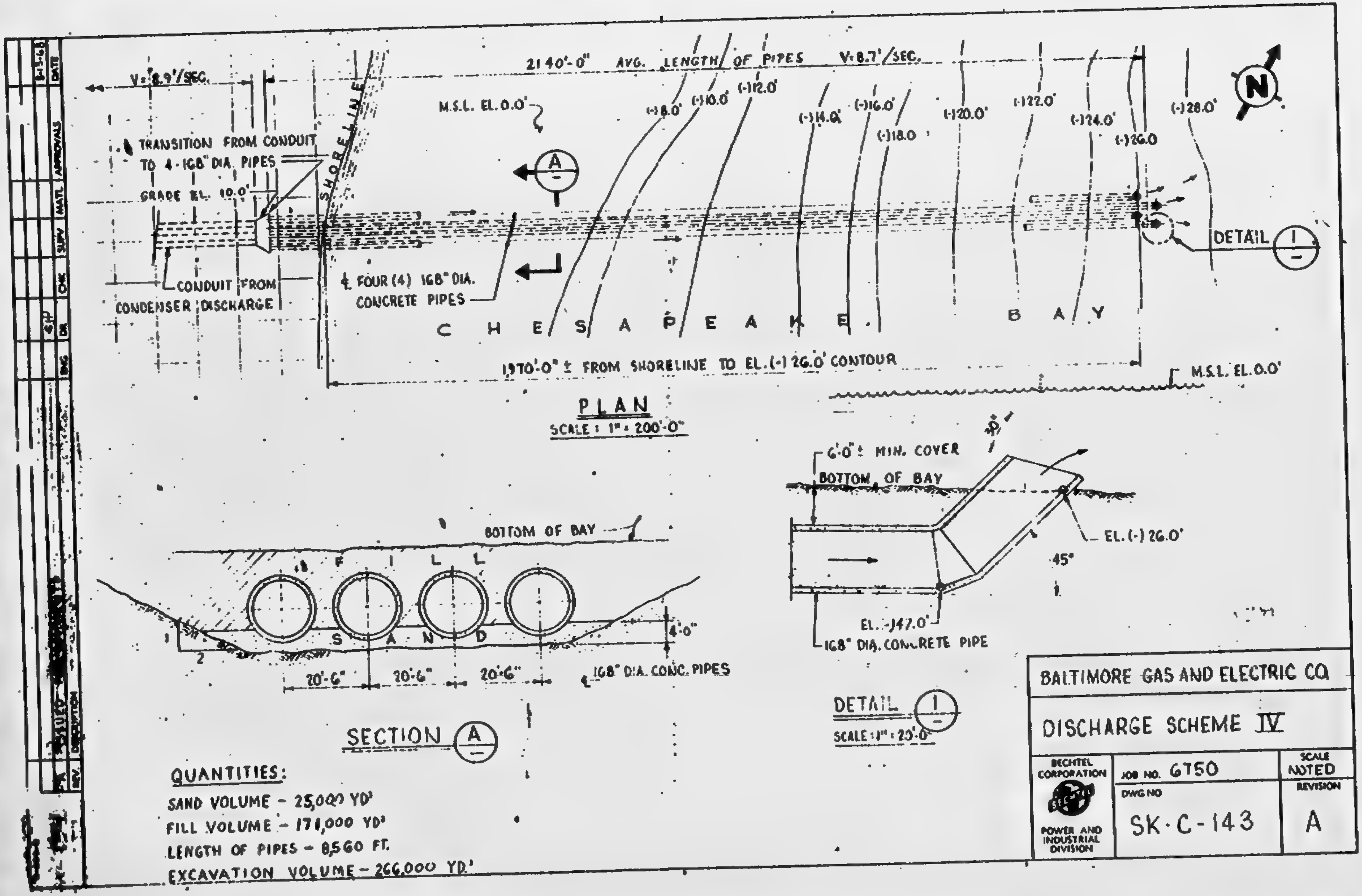
RECEIVED
OCT 21 1968
ALDEN RESEARCH LABORATORIES

BALTIMORE GAS AND ELECTRIC CO.

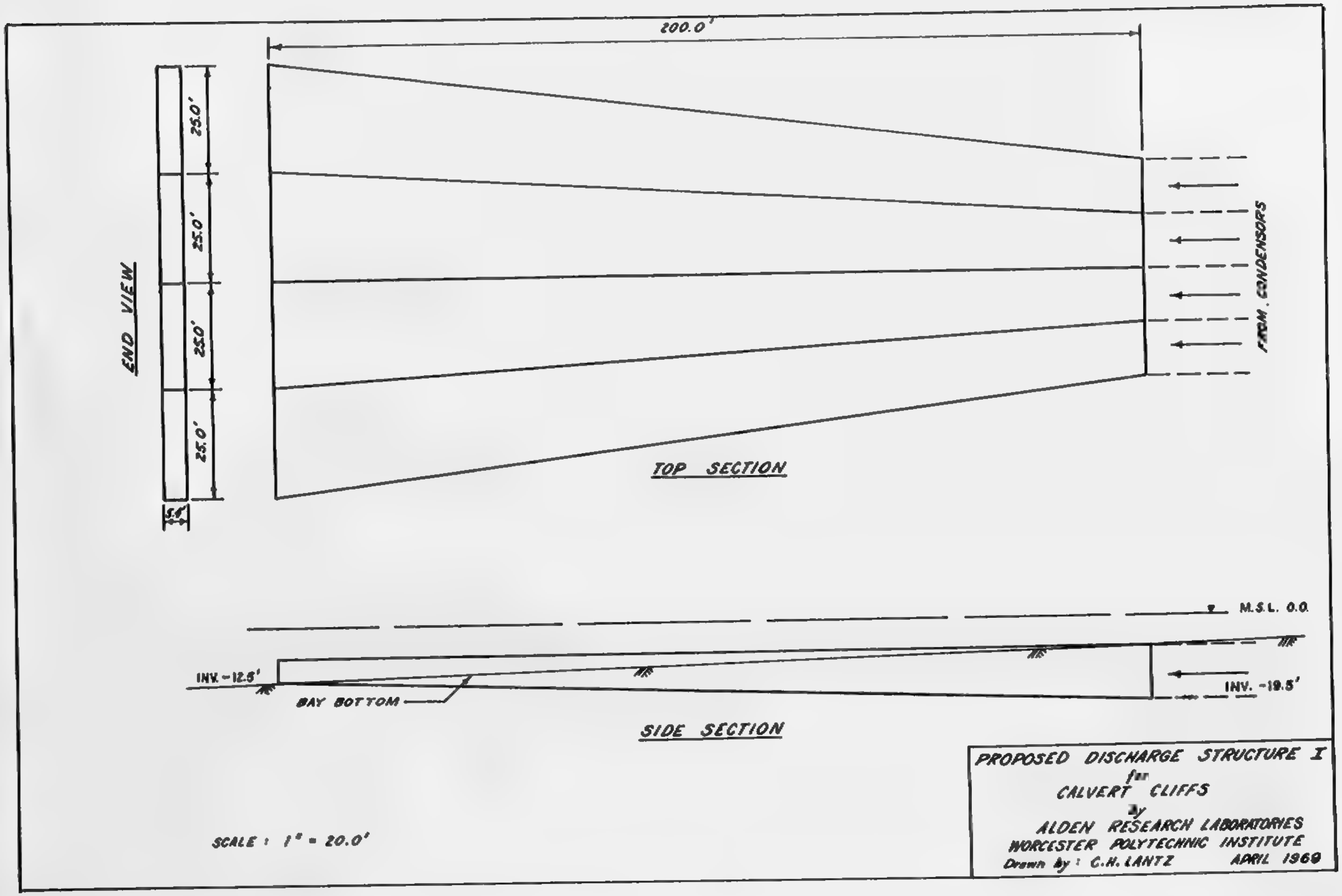
DISCHARGE SCHEME III

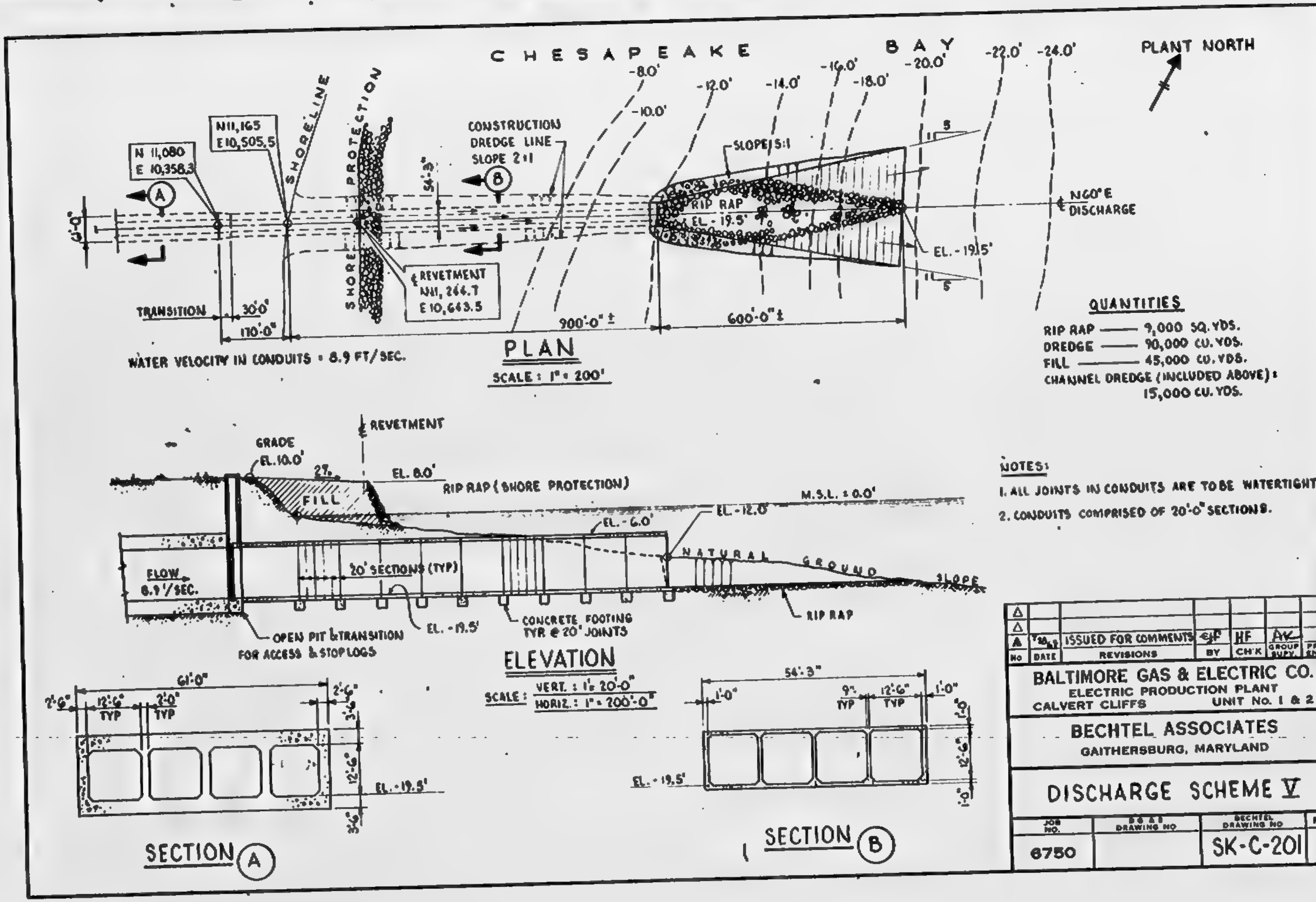
BECHTEL ASSOCIATES POWER AND INDUSTRIAL DIVISION	JOB NO. 6750	SCALE SHOWN
	DWG NO SK-C-142	REVISION B

REV.	DESCRIPTION	ENG	DR	CHK	SUPV	MATL	APPROVALS	DATE
B	ISSUED FOR COMMENTS							10-16
A	ISSUED FOR COMMENTS							



2140'-0" AVG. LENGTH OF PIPES V=8.7'/SEC.
V=8.9'/SEC.
M.S.L. EL.0.0'
TRANSITION FROM CONDUIT TO 4-168" DIA. PIPES
GRADE EL. 10.0'
SHORELINE
CONDUIT FROM CONDENSER DISCHARGE
℄ FOUR (4) 168" DIA. CONCRETE PIPES
(-)8.0' (-)10.0' (-)12.0' (-)14.0' (-)16.0' (-)18.0 (-)20.0' (-)22.0' (-)24.0' (-)26.0 (-)28.0'
DETAIL 1
C H E S A P E A K E B A Y
1970'-0" ± FROM SHORELINE TO EL.(-)26.0' CONTOUR
M.S.L. EL.0.0'
PLAN
SCALE: 1" = 200'-0"
6'-0" ± MIN. COVER
BOTTOM OF BAY
EL.(-)26.0'
45°
EL.-)47.0'
168" DIA. CONCRETE PIPE
DETAIL 1
SCALE: 1" = 20'-0"
BOTTOM OF BAY
F I L L
S A N D
4'-0"
20'-6" 20'-6" 20'-6"
℄ 168" DIA. CONC. PIPES
SECTION A
QUANTITIES:
SAND VOLUME - 25,000 YD³
FILL VOLUME - 171,000 YD³
LENGTH OF PIPES - 8,560 FT.
EXCAVATION VOLUME - 266,000 YD³
BALTIMORE GAS AND ELECTRIC CO.
DISCHARGE SCHEME IV
BECHTEL CORPORATION
POWER AND INDUSTRIAL DIVISION
JOB NO. 6750
SCALE NOTED
DWG NO SK-C-143
REVISION A
REV. DESCRIPTION ENG DR CHK SUPV MATL APPROVALS DATE


200.0'
25.0'
25.0'
25.0'
25.0'
5.5'
END VIEW
FROM CONDENSORS
TOP SECTION
M.S.L. 0.0
INV. -12.5'
INV. -19.5'
BAY BOTTOM
SIDE SECTION
SCALE : 1" = 20.0'
PROPOSED DISCHARGE STRUCTURE I
for
CALVERT CLIFFS
by
ALDEN RESEARCH LABORATORIES
WORCESTER POLYTECHNIC INSTITUTE
Drawn by : C.H. LANTZ APRIL 1969


CHESAPEAKE BAY
PLANT NORTH
-8.0'
-10.0'
-12.0'
-14.0'
-16.0'
-18.0'
-20.0'
-22.0'
-24.0'
N 11,080
E 10,358.3
N11,165
E10,505.5
SHORELINE
SHORE PROTECTION
CONSTRUCTION DREDGE LINE SLOPE 2:1
SLOPE 15:1
RIP RAP EL. - 19.5'
EL. - 19.5'
℄ N60°E DISCHARGE
℄ REVETMENT N11, 264.7 E10,663.5
TRANSITION
30'-0"
170'-0"
900'-0" ±
600'-0" ±
54'-3"
61'-0"
WATER VELOCITY IN CONDUITS = 8.9 FT/SEC.
PLAN
SCALE: 1" = 200'
QUANTITIES
RIP RAP — 9,000 SQ. YDS.
DREDGE — 90,000 CU. YDS.
FILL — 45,000 CU. YDS.
CHANNEL DREDGE (INCLUDED ABOVE): 15,000 CU. YDS.
℄ REVETMENT
GRADE EL. 10.0'
EL. 8.0'
FILL
RIP RAP (SHORE PROTECTION)
M.S.L. ± 0.0'
EL. - 6.0'
EL. - 12.0'
NATURAL GROUND SLOPE
FLOW 8.9'/SEC.
20' SECTIONS (TYP)
EL. - 19.5'
CONCRETE FOOTING TYP @ 20' JOINTS
RIP RAP
OPEN PIT & TRANSITION FOR ACCESS & STOP LOGS
ELEVATION
SCALE: VERT.: 1" = 20'-0" HORIZ.: 1" = 200'-0"
NOTES:
1. ALL JOINTS IN CONDUITS ARE TO BE WATERTIGHT.
2. CONDUITS COMPRISED OF 20'-0" SECTIONS.
2'-6"
12'-6" TYP
2'-0" TYP
3'-6"
12'-6"
EL. - 19.5'
SECTION A
1'-0"
9" TYP
12'-6" TYP
SECTION B
A
ISSUED FOR COMMENTS
HF
NO
DATE
REVISIONS
BY
CH'K
GROUP SUPV.
PROJ. ENGR.
BALTIMORE GAS & ELECTRIC CO.
ELECTRIC PRODUCTION PLANT
CALVERT CLIFFS UNIT No. 1 & 2
BECHTEL ASSOCIATES
GAITHERSBURG, MARYLAND
DISCHARGE SCHEME V
JOB NO.
BG & E DRAWING NO
BECHTEL DRAWING NO
REV.
6750
SK-C-201
A

IN THE

UNITED STATES COURT OF APPEALS

FOR THE DISTRICT OF COLUMBIA CIRCUIT

No. 24,839

CALVERT CLIFFS' COORDINATING COMMITTEE, INC.
NATIONAL WILDLIFE FEDERATION, AND
THE SIERRA CLUB,

Petitioners,

v.

UNITED STATES ATOMIC ENERGY COMMISSION, AND
THE UNITED STATES OF AMERICA,

Respondents,

BALTIMORE GAS AND ELECTRIC COMPANY,

Intervenor.

BRIEF FOR INTERVENOR

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IN THE

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TABLE OF CONTENTS

Table of Authorities .... (i)

COUNTERSTATEMENT OF THE ISSUES PRESENTED FOR REVIEW 1

COUNTERSTATEMENT OF THE CASE 2

I. The Nature of the Case, Course of Proceedings, and its Disposition 2

II. Statement of Facts 8

A. National Environmental Policy Act 8

B. Calvert Cliffs Plant 9

B.1. Review by the AEC 10

B.2. Review by Agencies of the State of Maryland 13

B.3. Independent Environmental Studies 19

B.4. Environmental Studies Conducted by BG&E. 24

B.5. Status of the Calvert Cliffs Plant 26

ARGUMENT 27

I. NEPA Does Not Require as a Matter of Law That AEC Issue an Order to Show Cause Why the Construction Permits for the Calvert Cliffs Plant Should Not Be Suspended 28

II. AEC Has Acted Reasonably in Implementing NEPA With Respect to Facilities Whose Construction Permits Were Issued Before January 1, 1970 33

III. AEC Acted Reasonably in Not Granting Petitioners' Request That a Show Cause Order Be Issued to BG&E 45

CONCLUSION 57

Addendum I

Addendum II

TABLE OF AUTHORITIES

I. CASES

Pages

Brooks v. Volpe, 2 BNA Envir. Rptr. 1004 (W.D. Wash. September 25, 1970) 30

Calvert Cliffs' Coordinating Committee, Inc., et al v. United States Atomic Energy Committee, D.C. Cir. No. 24,871 (filed December 7, 1970) 4, 8

Coakley v. Postmaster of Boston, Mass., 374 F.2d 209 (1st Cir. 1967) 43

Conley Electronics Corp. v. F.C.C., 394 F.2d 602 (10th Cir.), cert. denied 393 U.S. 858 (1968) 43

Ely v. Velde, 2 BNA Envir. Rptr. 1185 (E.D. Va. 1971). 34

F.C.C. v. Schreiber, 381 U.S. 279 (1965) 43

Environmental Defense Fund, Inc. v. Corps of Engineers, 2 BNA Envir. Rptr. 1173 (D.D.C. 1971) 31

Investment Syndicates, Inc. v. Richmond, 1 BNA Envir. Rptr. 1713 (D. Ore. October 27, 1970) 30

*Nader v. Federal Aviation Administration, No. 24,616 (D.C. Cir., March 4, 1971) 55

*NLRB v. Hearst Publications, Inc., 322 U.S. 111 (1944) 42

New York Foreign Freight F & B Assn. v. Federal Maritime Commission, 337 F.2d 289 (2nd Cir. 1964), cert. denied, 380 U.S. 910 (1965) 43

Northern States Power Company v. Minnesota, ____ F. Supp. ____ (D. Minn. 1970) 15

*Pennsylvania Environmental Council, Inc. v. Bartlett, 315 F. Supp. 238 (M.D. Pa. 1970) 30, 49

People's Counsel v. Public Service Commission, Md.Ct.App., No.41, decided November 2, 1970 16

Perkins v. Matthews, ____ U.S. ____, 27 L.Ed. 2d 476 (1971) 42

*Power Reactor Development Corp. v. International Union, 367 U.S. 396 (1961).. 41

Sierra Club v. Laird, D. Ariz. No. CIV-70-78-TUC June 23, 1970 (appeal filed in 9th Cir.)................ 30

Texas Committee on Natural Resources v. United States, 1 BNA Envir. Rptr. 1303 (W.D. Tex. 1970), subsequent appeal dismissed as moot, 430 F.2d 1315 (5th Cir.1970). 31

*Udall v. Tallman, 380 U.S. 1 (1965).................... 42

Unemployment Compensation Commission v. Aragon, 329 U.S. 143 (1946).................................... 43

United States v. Ekberg, 291 F.2d 913 (8th Cir.), cert. denied, 368 U.S. 920 (1961)..................... 43

Wilderness Society v. Hickel, 1 BNA Envir. Rptr. 1335 (D.D.C. 1970).. 31

II. STATUTES

Act of July 23, 1942, 56 Stat. 703...................... 32

Atomic Energy Act of 1954, 42 U.S.C. 2011 et seq....... 10, 11, 36, 46

Federal Water Pollution Control Act, 33 U.S.C. 1151 et seq.. 9, 14, 16, 40, 41, 48, 50

Fish and Wildlife Coordination Act, 16 U.S.C. §§ 661-665.. 32

*National Environmental Policy Act, 42 U.S.C.4321 et seq. 2, 4, 6, 8, 26, 27-36 40, 41, 44, 46, 47, 48, 51

Water Quality Improvement Act of 1970, P.L. 91-224, 84 Stat. 91.. 9, 16, 50, 51

Public Service Commission Law, § 54A (Art. 78, Md. Ann. Code, 1969 Replacement Vol.)........ 16

III. REGULATIONS

Interim Guidelines for the Preparation of detailed environmental statements, issued by the Council on Environmental Quality, 35 Fed. Reg. 7390, and proposed revisions thereto, 36 Fed. Reg. 18469 .... 9, 35

10 CFR, Part 2, § 2.202 .... 3, 45

10 CFR, Part 20 .... 10, 11, 12, 13, 15

10 CFR, Part 50 .... 12, 44

*10 CFR, Part 50, Appendix D 4, 8, 27, 36-41

Water Resources Regulation 4.8 of the State of Maryland 14, 23

IV. LEGISLATIVE HISTORY

S. Rpt. No. 91-296, 91st Cong., 1st Sess 29

115 Cong. Rec. S12114 (daily ed. October 8, 1969) 51

115 Cong. Rec. S17455, 17460 (daily ed. December 20, 1969) 49, 51

116 Cong. Rec. S4401 (daily ed. March 24, 1970) 52

V. MISCELLANEOUS

Executive Order 11514, 35 Fed. Reg. 4247 (1970) 9, 34

*"Nuclear Power Plants in Maryland", Report by the Governor's Task Force on Nuclear Power Plants (December 1969) 19, 20, 21, 52, 54

*Opinion of the Public Service Commission of Maryland, Case No. 6394, "In the Matter of the Application of Baltimore Gas and Electric Company for a Certificate of Public Convenience and Necessity, etc., January 19, 1971 .... 12, 17-19, 47, 53, 56

Order No. 57778, Public Service Commission of Maryland. 16

Reorganization Plan No. 3 (1970)........................ 48

*Report to the Maryland Academy of Sciences by the Study Panel on Nuclear Power Plants (January 1970)........... 21-24, 52, 54

Testimony of Russell E. Train, Chairman, Councel on Environmental Quality, before House Merchant Marine Committee, BNA Environmental Reporter: 1 Current Developments 837 (December 11, 1970)..................... 45

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*Cases and authorities chiefly relied upon are marked by asterisks.

COUNTERSTATEMENT OF THE ISSUES PRESENTED FOR REVIEW

1. Does the National Environmental Policy Act of 1969 require the Atomic Energy Commission, as a matter of law, to issue an order to show cause why the construction permits for the Calvert Cliffs Nuclear Power Plant should not be suspended.

2. Did the Atomic Energy Commission, as a matter of administrative discretion, act reasonably in not granting Petitioners' request for an order to show cause why the construction permits for the Calvert Cliffs Nuclear Power Plant should not be suspended pending investigation of environmental matters.

COUNTERSTATEMENT OF THE CASE

I. The Nature of the Case, Course of Proceedings, and its Disposition.

On June 29, 1970, the Calvert Cliffs' Coordinating Committee, Inc., Natural Wildlife Federation, and the Sierra Club (hereafter Petitioners) filed a Petition with the U. S. Atomic Energy Commission (hereafter AEC). J.A. II, 31.[1/] Petitioners requested that the AEC undertake three actions with respect to the Calvert Cliffs Nuclear Power Plant (hereafter the plant or Calvert Cliffs Plant) being constructed by Intervenor Baltimore Gas and Electric Company (hereafter BG&E):

"1. This petition requests that the Commission:

"(a) immediately order Baltimore Gas and Electric Company (hereinafter BG&E) to prepare and submit with respect to the Calvert Cliffs Nuclear Power Plant, the environmental statement required by the National Environmental Policy Act (hereinafter NEPA) and by the regulations of the Commission;

1/ Joint Appendix Volume I is referred to herein as J.A. I. Joint Appendix Volume II is referred to herein as J.A. II.

> "(b) immediately begin the environmental studies required by NEPA with respect to the proposed plant to determine if, in light of these environmental studies, modifications in the location, design, method of construction or operation, or any other aspect of the proposed plant are required;
>
> "(c) issue to BG&E pursuant to 10 CFR, Part 2, § 2.202 an order to show cause why the construction permit issued on July 2[sic], 1969 should not be suspended pending investigation of these environmental factors." J.A. II, 32.

In addition, Petitioners also requested that AEC carry out a general rule making proceeding to:

> "promulgate rules and regulations for applying NEPA to all nuclear power plants for which construction permits (or provisional construction permits) have been issued and which have not as yet received operating licenses." J.A. II, 32.

The AEC's reply to the Petition, "Notice of Filing of Petition for Rule Making and Denial of Petition for Rule Making in Light of Pending Rule Making Proceeding" (J.A. II, 173), dealt separately with the two aspects of the Petition. With regard to the general rule making request, AEC noted that it was presently conducting a rule making proceeding concerning its implementation of the National Environmental Policy Act of 1969[2/] (hereafter NEPA) and that, rather than conduct a further, separate rule making proceeding,

> "The Commission will consider carefully, and address itself to, the matters raised by the petition for rule making in the current rule making proceeding to amend Appendix D of Part 50." J.A. II, 176.

Petitioners' specific requests relating to the Calvert Cliffs Nuclear Power Plant were referred with the following instructions to the AEC's Director of Regulation.

> "It is expected that the Director of Regulation will take action on these requests following the completion of the rule making

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2/ This rule making proceeding culminated with the publication on December 4, 1970, of a revised version of Appendix D to 10 CFR, Part 50. J.A. I, 5. On December 7, 1970, Petitioners filed in this Court a Petition for Review of that rule making proceeding. Calvert Cliffs' Coordinating Committee, Inc. et al. v. United States Atomic Energy Commission, et al., No. 24,871.

proceeding which is presently underway, the outcome of which will determine the action to be taken." J.A. II, 177.

On November 12, 1970, Petitioners filed with the AEC a Supplemental Memorandum in support of the June 29, 1970, Petition. J.A. II, 75. This Memorandum dealt only with the three requests directed specifically at the Calvert Cliffs Plant. Petitioners requested that AEC act within ten days on these requests.

Petitioners commenced this action on November 25, 1970, treating AEC's failure to act on its requests as AEC "orders" denying the petition. The Petition for Review to this Court challenged three "orders",

1. "the order of the Atomic Energy Commission refusing to issue an order to the Baltimore Gas and Electric Company to show cause why the construction permit for the Calvert Cliffs Nuclear Power Plant should not be suspended pending a complete study of the environmental impact of the plant",

2. "the order of the Atomic Energy Commission in refusing to require Baltimore Gas and Electric Company to submit

as soon as possible an environmental statement with respect to the Calvert Cliffs plant as required by the rules and regulations of the Atomic Energy Commission", and

3. "the order of the Atomic Energy Commission in refusing to immediately begin preparation of a detailed environmental statement with respect to to the Calvert Cliffs plant as required by the National Environmental Policy Act of 1969."

Petition for Review, pp. 1-2. These three requests clearly follow requests (a), (b) and (c) in the June 29, 1970, Petition to the AEC, set forth above.

At the time Petitioners filed this action, their second and third requests to this Court had already become moot. On November 17, 1970, BG&E on its own initiative submitted to the AEC its Environmental Report on the Calvert Cliffs Plant (hereafter BG&E's Environmental Report).3/ 6 Cert. Rec. 2838-3064.4/ On November 25, 1970, AEC, in its response to Petitioners'

3/ A copy of BG&E's Environmental Report is attached to this Brief as Addendum II.

4/ Citations to documents in the Certified Record are by volume number, Cert. Rec., page number.

Supplemental Memorandum, informed Petitioners of BG&E's Environmental Report and also notified them of AEC's plans with respect to the report:

> "You will be interested to know that we received on November 18, 1970, an environmental report on the Calvert Cliffs Nuclear Power Plant prepared by Baltimore Gas and Electric Company. We are presently reviewing the report and plan to forward it to the cognizant agencies for their review and comment. We are sending you a copy under separate cover." J.A. II, 179.

Thus, the only request of Petitioners to the AEC and to this Court which had not been rendered moot is the matter of the order to show cause.

In their Brief, Petitioners seek to inject other issues into this proceeding, namely whether AEC has acted arbitrarily and capriciously by

> "2. Refusing to consider any modification of the construction permit for the Calvert Cliffs Nuclear Power Plant regardless of the results of the study by the Atomic Energy Commission of the environmental impact of the plant;

> "3. Refusing to modify the construction permit for the Calvert Cliffs Nuclear Power Plant to require that technological advances in plant design and and equipment be backfitted on the plant where such backfitting will substantially improve environmental protection." (Petitioners' Brief, p. 1).

As set forth above, these issues were not raised before the AEC nor were they included in the Petition to this Court, and these issues are therefore not properly presented in this case.[5/]

II. Statement of Facts.

A. National Environmental Policy Act.

On January 1, 1970, the President signed into law the National Environmental Policy Act of 1969, 42 U.S.C. § 4321 et seq.[6/] On April 2, 1970, AEC became the first agency to publish regulations implementing NEPA. Appendix D to 10 CFR, Part 50 (hereafter Appendix D), 35 Fed. Reg. 5464. A proposed

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5/ Similar issues were raised by Petitioners in their petition for review of AEC's general rule making proceeding and may be properly before this Court in Case No. 24,871.

6/ The text of NEPA is set out in Addendum I attached to this Brief, p. A1.

revised version of Appendix D was published for public comment on June 3, 1970. J.A. II, 169. This proposed revision was largely in response to the enactment on April 3, 1970, of the Water Quality Improvement Act of 1970, which added section 21(b) to the Federal Water Pollution Control Act, 33 U.S.C. § 1171, and the publication on May 12, 1970, by the Council on Environmental Quality of Interim Guidelines to Federal agencies for the preparation of the detailed environmental statements required by NEPA. 35 Fed. Reg. 7390.

After consideration of comments received by AEC, including comments from Petitioners, and presumably after consultation with the Council on Environmental Quality as anticipated by Section 3 of Executive Order 11514, AEC on December 4, 1970, published a revision to Appendix D, to be effective thirty days after publication. J.A. I, 5.

B. <u>Calvert Cliffs Plant</u>.

The material filed by Petitioners in support of their Petition to the AEC is concerned solely with the possible environmental effects associated with the intake and discharge of cooling water and the discharge of radioactive effluents. This Statement of Facts is therefore concerned only with these matters.

B.1. Review by the AEC.

On January 25, 1968, BG&E filed with AEC an application for a permit to construct Units 1 and 2 of the Calvert Cliffs Plant. 1 Cert. Rec. 7. BG&E's multi-volume Preliminary Safety Analysis Report, 1 Cert. Rec. 72-468, 2 Cert. Rec. 469-1019, was filed with the application and described in detail the plant including facilities for limiting and controlling radioactive discharges. A thorough review of radiological health and safety matters, including radiological environmental effects, was conducted by the AEC regulatory staff, see 1-5 Cert. Rec. 5-1477, 1486-1588, and by the Advisory Committee on Reactor Safeguards.[7/] 4 Cert. Rec. 1553. As a part of this review, AEC sought and obtained the advice and comments of other Federal agencies with expertise in relevant areas, including radiological environmental effects. See Letter from Fish and Wildlife Service, Department of the Interior, to AEC, dated July 26, 1968, App. G to Safety Evaluation by the Division of Reactor Licensing, 4 Cert. Rec. 1486. Based upon its studies and the information which had been submitted to it, the AEC regulatory staff concluded that the discharges of small quantities of radioactive effluent would be within the limits established by the AEC's regulations, 10 CFR, Part 20, and noted that specific radionuclide limits would be

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7/ The Advisory Committee on Reactor Safeguards is an independent body created by Section 29 of the Atomic Energy Act of 1954, 42 U.S.C. § 2039, and required to review each application for a construction permit, Section 182(b) of the Atomic Energy Act of 1954, 42 U.S.C. § 2232(b).

established at the operating license stage. Safety Evaluation by the Division of Reactor Licensing, p. 28, 4 Cert. Rec. 1486.

Pursuant to the Atomic Energy Act of 1954 and AEC's regulations, a public hearing on the application for a construction permit was held before an Atomic Safety and Licensing Board in Prince Frederick, Maryland, on May 12 and 13, 1969. 5 Cert. Rec. 1861-2429, 6 Cert. Rec. 2430-2592. The principal intervenor at the hearing was the Chesapeake Environmental Protection Association, Inc.,[8/] and the principal contested issue involved the discharge of radioactive material, more particularly the liquid waste discharge containing tritium. The Association contended that there was insufficient knowledge of the effects of these discharges into Chesapeake Bay to be able to rely upon the AEC regulations establishing the limits for radioactive discharges, 10 CFR, Part 20. The Association did not question that the plant would operate within AEC's regulations. Both the Association and BG&E introduced substantial expert testimony.

After considering all the evidence, the Board found that the plant would comply with AEC's regulations and that there was no evidence introduced such as to draw into question the

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8/ The Chesapeake Environmental Protection Association, Inc. is one of the members of the Calvert Cliffs' Coordinating Committee, Inc., one of the Petitioners herein. The Association also intervened in State agency proceedings as described below.

validity of the regulations themselves. Initial Decision issued by the Atomic Safety and Licensing Board, "In the Matter of Baltimore Gas and Electric Company (Calvert Cliffs Nuclear Power Plant, Units 1 and 2)", June 30, 1969, J.A. II, 11. The Association did not appeal from this decision either to the Atomic Energy Commission or to the courts. Based upon the decision of the Atomic Safety and Licensing Board, Provisional Construction Permits Nos. CPPR-63 and CPPR-64 were issued to BG&E on July 7, 1969. 6 Cert. Rec. 2679, 2681.

The AEC has also recently amended its regulations to require that radioactive discharges from licensed facilities be kept as low as practicable, normally small percentages of the 10 CFR, Part 20 limits and that waste treatment equipment installed in the plant be used and maintained to comply with this objective. 10 CFR §§ 20.1, 50.34a, 50.36a, 35 Fed. Reg. 18385 (1970). BG&E has estimated that 99.9999 percent of the radionuclides, with the exception of tritium, would be removed from the primary coolant system before it is discharged into Chesapeake Bay. See Opinion of the Public Service Commission of Maryland, "In the Matter of the Application of Baltimore Gas and Electric Company for a Certificate of Public Convenience and Necessity, etc.", Case No. 6394, January 19, 1971, pp. 10-11 (hereafter PSC Opinion).[9/] With both plant units in operation,

9/ The PSC Opinion is set forth in Addendum I attached to this Brief, p. A6.

the maximum annual average discharges of all radionuclides, other than tritium, are expected to be less than one percent of AEC's limits as set forth in 10 CFR, Part 20. See BG&E's Environmental Report, Table 2.3.1., (Addendum II, p. 29), 6 Cert. Rec. 2838. Tritium discharges are expected to be only 0.05 of one percent, or one-two thousandth, of the AEC limits. Initial Decision issued by the Atomic Safety and Licensing Board, p. 10. J.A. II, 20.

AEC is currently reviewing the non-radiological environmental effects of the Calvert Cliffs Plant. Pursuant to NEPA, it has now reviewed BG&E's Environmental Report and has transmitted that report, along with the "Draft Detailed Statement on Environmental Considerations, U. S. Atomic Energy Commission, Related to the Proposed Operation of Calvert Cliffs Nuclear Power Plant, etc." (hereafter AEC Draft Detailed Statement), ____ Cert. Rec. ____, to cognizant agencies for their review and comment. ____ Cert. Rec. ____.

B.2. Review by Agencies of the State of Maryland.

In addition to review by the AEC, various agencies of the State of Maryland have thoroughly considered all aspects of the environmental effects of the Calvert Cliffs Plant. On December 10, 1969, BG&E applied to the Department of Water Resources for a permit to use water from Chesapeake Bay for the purpose of providing cooling water for the plant. See J.A. II, 188. On February 5, 1970, BG&E applied for a permit to construct the necessary intake and discharge structures. See J.A. II, 189. Public hearings were held on these applications by

the Department of Water Resources on February 18-19 and March 2 and 10, 1970. See J.A. II, 192. The Chesapeake Environmental Protection Association, Inc. (the intervenors at the AEC construction permit proceeding) intervened and presented testimony. National Wildlife Federation, one of the Petitioners herein, also appeared at this hearing. The Department issued the permits effective July 15, 1970. Permits for Construction in a Waterway and Appropriation and Use of Surface Water-Calvert Cliffs Nuclear Power Plant, J.A. II, 188. A partial list of documents and reports which were before the Department is included in the permits and indicates the considerable depth of knowledge available to the Department at that time. J.A. II,189-190.

The permits contain a number of conditions, including the requirement that BG&E comply fully and at all times with Maryland's water quality standards, and specifically those relating to temperature.10/ J.A. II, 192, 193. Maryland's water quality standards, set forth in Water Resources Regulation 4.8, have been approved by the Secretary of the Interior pursuant to Section 10 of the Federal Water Pollution Control Act, 33 U.S.C. § 1160. J.A. II, 186. The Permits require BG&E to

> "alter, reduce or cease operation of the Calvert Cliffs Nuclear Power Plant, at the direction of the Department when and if

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10/ The principal standards affecting the Calvert Cliffs Plant are those relating to water temperatures during the warm months of the year. These standards limit increase in the temperature of intake water from the Bay to 10°F. Water Resources Regulation 4.8, p. 31; Department of Water Resources Permits, J.A. II, 193.

> the Department reasonably determines that such operation is causing, or will cause unlawful impairment of the quality of the Waters of the State and/or damage to the natural resources of the Waters of the State", J.A. II, 192, and

> "continue efforts to further reduce impact of the operation of the Calvert Cliffs Nuclear Power Plant on the Waters and Water Resources of the State and shall apply new technologies, when, in the opinion of the Department, such technologies become technically and economically feasible to further reduce release of heat to the Waters of the State." J.A. II, 194.

The Permits also require continuing scientific study, environmental monitoring and reports.

The Department of Water Resources also examined the radiological discharges from the plant. The Permits imposed limits of not to exceed one percent of the limits established by the AEC in 10 CFR, Part 20. J.A. II, 193. While there is a question as to the State's authority to impose limits on the Calvert Cliffs Plant's radiological discharges,[11] the fact remains that the Department has concluded that releases at the permitted level

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11/ Northern States Power Company v. Minnesota, _____ F. Supp. _____ (D. Minn., 1970).

would not be likely to cause harm to the environment. Under normal operations the plant radiological discharges will be less than one percent of AEC limits. See BG&E's Environmental Report, Table 2.3.1., (Addendum II, p. 29), 6 Cert. Rec. 2838.

Subsequent to the issuance of the permits, the Department of Water Resources issued a certification to BG&E that there is a reasonable assurance that discharges from the Calvert Cliffs Plant would not violate Maryland's water quality standards. J.A. II, 185. This certification was issued in compliance with the requirements of Section 21(b)(1) of the Federal Water Pollution Control Act, added by the Water Quality Improvement Act of 1970, 33 U.S.C. § 1171(b).

The Maryland Public Service Commission, while considering BG&E's application for a certificate of public convenience and necessity for the Calvert Cliffs Plant has also recently considered the plant's environmental impact.[12/] Section 54A

12/ Section 54A of the Public Service Commission Law of Maryland (Art. 78, Md. Ann. Code, 1969 Replacement Vol.), which became effective July 1, 1968, requires electric companies to obtain a certificate of public convenience and necessity for any generation station the construction of which is begun after July 1, 1968. The Public Service Commission ruled, after hearings on the matter, that construction of the Calvert Cliffs Plant had begun within the meaning of the law prior to July 1, 1968, and that no certificate was therefore required. Order No. 57778, July 31, 1969. This ruling was affirmed by the Circuit Court for Anne Arundel County but reversed by the Maryland Court of Appeals on October 23, 1970. People's Counsel v. Public Service Commission, No.41, J.A. II, 85. Accordingly, on November 2, 1970, BG&E filed with the Commission an application for a certificate of convenience and necessity.

of the Public Service Commission Law mandates that final action on an application for a certificate of public convenience and necessity be preceded by a public hearing and by "due consideration of the recommendations of [the local] governing bodies, the need to meet present and future demands for service, . . . esthetics, historic sites, and, when applicable, the effect on air and water pollution."[13/] Public hearings were held by the Public Service Commission at which several intervenors, including the Chesapeake Environmental Protection Association, Inc. (the intervenors in the AEC construction permit proceeding and at the Department of Water Resources permit proceeding), presented testimony. The People's Counsel participated throughout the hearing and presented fourteen witnesses. The Public Service Commission's forty page opinion, handed down on January 19, 1971, carefully summarized the testimony received at the hearing. Addendum I, p. A6.

The local governing body, the Board of County Commissioners of Calvert County, recommended that the certificate of public convenience and necessity be granted. PSC Opinion, pp. 30-31 (Addendum I, pp. A35-36). With regard to the need for power, the Public Service Commission concluded that, even considering BG&E's interconnection with other electric utilities,

> "[t]he need for the facility to meet present and future demands for service was established

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13/ The text of Section 54A is set forth on p. 2 of the PSC Opinion (Addendum I, p. A7).

> by BG&E . . . . Without the facility at Calvert Cliffs [BG&E] in 1973 would have essentially a zero reserve capacity and in 1974 the load during peak is estimated to exceed the capacity by 336 megawatts (or by minus 8.3 percent). Parenthetically, it may be noted that an independent study submitted by the Chamber of Commerce of Metropolitan Baltimore concluded that without generation from Calvert Cliffs the metropolitan area will be short over 700 megawatts by the end of 1975." PSC Opinion, p. 31 (Addendum I, p. A36).

The Public Service Commission's opinion found no evidence of criticism as to the esthetics of the plant or its effect on historic sites. PSC Opinion, p. 35 (Addendum I, p. A40).

As to "the effect on air and water pollution," the Public Service Commission stated,

> "It is our belief that the evidence in this case that bears on the effect of the operation of the Calvert Cliffs nuclear power plant on air and water pollution supports the conclusion that there will be no significant adverse effect in this regard." PSC Opinion, p. 38 (Addendum I, p. A43).

In reaching this conclusion, the Commission had before it the Department of Water Resources permit and testimony by the

Director of that Department, PSC Opinion, p. 20 (Addendum I, p. A25); testimony of "a number of highly qualified, science-oriented experts", PSC Opinion, p. 36 (Addendum I, p. A41); testimony by the Chairman of the Governor's Task Force on Nuclear Power Plants, PSC Opinion, pp. 19, 37 (Addendum I, pp. A24, A42); and a letter from the Department of Natural Resources, PSC Opinion, p. 21 (Addendum I, p. A26).

In his letter to the Public Service Commission, the Secretary of the Maryland Department of Natural Resources advised that the Department had determined that the plant would not significantly threaten or materially impair the water quality of the Chesapeake Bay provided that the facility is operated in compliance with the strict standards set by Federal and State authorities, and that the plant operated in accordance with these conditions would not constitute a hazard to the environment, the Chesapeake Bay or the general public. PSC Opinion, p. 21 (Addendum I, p. A26).

B.3. Independent Environmental Studies.

Both the Department of Water Resources and the Public Service Commission had before them in the permit and certificate proceedings two independent studies of the environmental impact of the Calvert Cliffs Plant: a Report entitled "Nuclear Power Plants in Maryland" issued in December 1969 by the Governor's Task Force on Nuclear Power Plants (hereafter Task Force) and a Report to the Maryland Academy of Sciences by the Study Panel

on Nuclear Power Plants. These studies were also made available to AEC. The seventeen member Task Force was appointed by Governor Marvin Mandel on July 10, 1969, who addressed to it the following question:

> "Do the special characteristics of nuclear power plants constitute a sufficient threat to the health, safety, or economy of Maryland or its citizens to justify further action on the part of the State?" Task Force Report, p. 2.

Special consideration was to be given to the Calvert Cliffs Plant. In its 170 page report, the Task Force examined the environmental effects of electric generating plants, both fossil and nuclear powered, and the particular effects of the Calvert Cliffs Plant, including an evaluation of alternative cooling methods. As a result of its study, the Task Force concluded,

> "Based upon careful consideration of available evidence, the Task Force concludes that the Calvert Cliffs Nuclear Power Plant, operating in compliance with Federal and State Laws and Regulations, does not in itself constitute a threat in any significant way to the health, safety, or economy of the State of Maryland or its citizens, nor will the plant seriously impair the quality of

the Chesapeake Bay environment." Task Force Report, p. 6.[14/]

What Petitioners have referred to as "one of the most thorough reports prepared with respect to the plant", Brief for Petitioners, p. 22, was submitted in January, 1970, to the Maryland Academy of Sciences, a private, non-profit, educational foundation, by the Study Panel on Nuclear Power Plants. The Panel was composed of four scientists, two of whom also served on the Governor's Task Force. The Panel heard testimony during eleven three hour sessions from numerous scientists and engineers from universities, government and industry.

Here are some of the things which the Panel found.

> "It is of interest to note that in the construction of its Calvert Cliffs plant, the Baltimore Gas and Electric Company is making a serious attempt to insure that the environment is protected by the investment of some $1,500,000 over a period of eight years in environmental studies both before and after anticipated plant operation." Report, pp. 5-6.
>
> "The Baltimore Gas and Electric Company claims that these studies are the most extensive yet undertaken in connection with the

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14/ Task Force's summary of the considerations on which this conclusion was based is set out in Addendum I attached to this Brief, p. A49.

construction of any nuclear plant in the country, and we have seen no evidence to the contrary." Report, p. 6.

"The panel is persuaded that the engineering design for the intake of Bay water into the plant, its passage through the condenser tubes and its discharge back into the Bay is prudent, cautious and responsive to State regulations and to biological research." Report, p. 6.

"[T]he panel is persuaded that these [ecological studies represent a serious attempt by the Baltimore Gas and Electric Company to insure environmental protection. We found no evidence to suggest that the Company is using these studies as a camouflage or that it would not be responsive to recommendations that might emerge as a result of the research programs." Report, p. 32.

"Excluding unforeseen and highly improbable accidents, [the plant] will release radioactivity to the environment significantly below maximum levels presently considered acceptable by the Atomic Energy Commission and will contribute a dose to the general public surrounding the plant also significantly below the more stringent allocations recommended in this report.

The plant design, safety features and emergency procedures have been examined by the Atomic Energy Commission and are such that in the event of an extremely improbable accident, it is unlikely that persons outside the plant site will be subjected to dangerous levels of radiation. The cooling system is designed to comply with Maryland Water Quality Regulations relating to the heating of Bay water. There will be small but measurable temperature changes in the Bay water surrounding this site which may have some effect on the organisms in this immediate area. We expect these effects to be small." Report, pp. 32-33.

The Panel concluded,[15/]

15/ Petitioners seriously misrepresent the conclusion of the Panel's Report when they quote from the Report,

> "In particular, we of the panel deplore the fact that the nuclear power station being built by Baltimore Gas and Electric Company at Calvert Cliffs was sited and designed, at least in general terms, before any such survey [<u>of the environmental impact of the plant</u>] was made."
> Brief for Petitioners, p. 22. (emphasis added).

The underscored language was added by Petitioners to explain what the Panel allegedly meant by "such survey." The sentence in the Panel's Report which immediately precedes the quoted language clearly indicates that the Panel was in fact not deploring the failure to survey the plant's environmental impact, but rather the fact "that no long-range comprehensive view seems to have been taken of the development of the region and its projection into the future, taking into account the resources entrusted to us and their wise use for the benefit of society as a whole." Report, p. 1.

"We recognize that there are many areas in which further research is needed - these are described later in the report - but based upon the best information available at this time concerning the expected biological, chemical and physical impact of the Calvert Cliffs plant in normal operation, we have concluded that, in all probability, the plant will not of itself represent a major environmental threat."
Report, p. 2.

B.4. Environmental Studies Conducted by BG&E.

Before construction started at the Calvert Cliffs site, BG&E began environmental studies to determine and minimize the environmental effects caused by the plant. In October 1967, the Alden Research Laboratories of Worcester Polytechnic Institute were selected to construct a model of a section of Chesapeake Bay to develop information needed to design the plant so as to meet Maryland's water quality criteria and the various criteria established to protect aquatic life. An Advisory Committee was established, in cooperation with the Board (now the Department) of Natural Resources to review the testing program, suggest any changes, evaluate the results and prepare a report on their consensus as to the degree of validity of the final predictions from the model results. The Committee consisted of the Director, Natural Resources Institute, University of Maryland; the Director, Department of Water Resources; the Director

Chesapeake Bay Institute, The Johns Hopkins University; the Chairman of the Department of Geography and Environmental Engineering, The Johns Hopkins University; the Director of Alden Research Laboratories; and a consulting engineer. BG&E's Environmental Report (Addendum II, pp.16-17), 6 Cert. Rec. 2838. A Summary Report of these model studies appears at the end of the report.

In November 1967, BG&E retained the Academy of Natural Sciences of Philadelphia to conduct a continuing research program to measure the effect of the plant's operations on the water quality, biota and established water uses of the Chesapeake Bay. BG&E's Environmental Report, Appendix C (Addendum II), 6 Cert. Rec. 2838. These studies will provide a five-year baseline of the condition of the Bay and aquatic life in the vicinity of the plant prior to operation. The Chairman of the Department of Limnology of the Academy provided design criteria for the cooling system so as to produce as little change as possible in the ecosystem of the Bay.[16/] Also in 1967, BG&E retained Sheppard T. Powell Associates to carry out studies on the physical characteristics of the Bay in the vicinity of the Calvert Cliffs site. BG&E's Environmental Report (Addendum II, p. 9), 6 Cert. Rec. 2838. See J.A. II, 189, 190 for a partial list of these study reports. Copies of the environmental studies conducted for BG&E were also made available to AEC.

16/ The principal criteria which were adopted are set forth in BG&E's Environmental Report (Addendum II, pp. 13-14) 6 Cert. Rec. 2838.

B.5. <u>Status of the Calvert Cliffs Plant</u>.

The Calvert Cliffs Plant is being constructed at an estimated cost of approximately $347,000,000, which excludes the cost of fuel. PSC Opinion, p. 5 (Addendum I, p. A10). Unit 1 of the plant is scheduled for start-up in mid-1972 and Unit 2 is scheduled to follow about a year later. AEC Draft Detailed Statement, p. 1, ____ Cert. Rec. ____. Site preparation for the plant began early in 1968. PSC Opinion, p. 3 (Addendum I, p.A8). Construction was about one-third completed by the end of 1970. AEC Draft Detailed Statement, p. 1, ____ Cert. Rec. ____.

As is shown by Table 1 of the Affidavit of John W. Gore,Jr., Vice-President--Engineering and Construction of BG&E (Addendum I, p. A55), over $50 million had been spent on the project as of January 1, 1970, the date NEPA was enacted. As of December 31, 1970, more than $124 million had been spent. Photographs showing the status of construction at the plant site as of December 18, 1969, June 23, 1970, November 6, 1970, and March 6, 1971, are attached to Mr. Gore's Affidavit as Exhibits A, B, C and D (Addendum I, pp. A56-A59). These photographs show the status of the plant as of approximately the date NEPA was enacted, the date Petitioners' Petition to AEC was submitted, the date Petitioners' Petition for Review to this Court was filed, and the date on which this Brief was prepared. A photograph showing the site as of October 6, 1970, appears in BG&E's Environmental Report, Figure 2.5-3 (Addendum II, p. 44), 6 Cert. Rec. 2838.

ARGUMENT

Petitioners would have this Court order AEC to issue BG&E an order to show cause why construction of the Calvert Cliffs Plant should not be suspended pending a full investigation of its environmental impact. Petitioners seek a "show cause hearing" at which BG&E would have the burden of proving that continued construction would best serve the public interest. "The public" and "environmentalists" would be allowed to demonstrate how further construction "would foreclose possibly important environmental modifications". Brief for Petitioners, pp. 18, 20-21.

The hearing would be in addition to the public hearings already held by the AEC, the Maryland Department of Water Resources and the Maryland Public Service Commission to consider the environmental impact of proposed discharges to the Chesapeake Bay. It would also be in addition to any public hearing which AEC may hold pursuant to Appendix D of Part 50 prior to the issuance of an operating license, either on its own initiative or at the request of an interested party, to consider the environmental impact of the Calvert Cliffs Plant.

Petitioners' proposal has absolutely no basis in the statutory framework of the National Environmental Policy Act, it is at odds with the reasonable approach which AEC has taken in implementing NEPA, it is at odds with the reasonable approach which AEC has taken in applying NEPA to the Calvert Cliffs Plant, and it is completely oblivious to the particular factual situation which the Calvert Cliffs Plant presents.

I. NEPA Does Not Require as a Matter of Law That AEC Issue an Order to Show Cause Why the Construction Permits for the Calvert Cliffs Plant Should Not Be Suspended.

In an argument singularly devoid of any reliance on the specific statutory provisions of NEPA, Petitioners assert that NEPA requires AEC, almost two years after it has issued the construction permits for the Calvert Cliffs Plant and almost two years before it will rule on BG&E's application for operating licenses, to issue a show cause order and hold a public hearing on whether construction should be suspended because of environmental considerations.

As Petitioners correctly point out, the National Environmental Policy Act contains both a statement of national policy for the environment and a set of "action-forcing" procedures applicable to Federal agencies.

> "A statement of national policy for the environment--like other major policy declarations--is in large measure concerned with principle rather than detail; with an expression of broad national goals rather than narrow and specific procedures for implementation. But, if goals and principles are to be effective, they must be capable of being applied in action. S.1075 thus incorporates certain 'action-forcing' provisions

and procedures which are designed to assure that all Federal agencies plan and work toward meeting the challenge of a better environment." S. Rpt. No. 91-296, 91st Cong., 1st Sess., p. 9.

Petitioners do not point to any provision of NEPA which specifically requires the kind of action which they seek from the AEC. In fact, they cannot do so, since there is no such provision. The "action-forcing" procedures set out in Section 102 make no reference to show cause orders or to any preliminary public proceeding prior to the time that the Federal agency has had the opportunity to study the environmental effects of the action which it proposes to take and to obtain the comments of appropriate Federal, State and local agencies. Section 102(2)(C), Addendum I, p. A2.

Rather than follow the procedures set forth in NEPA itself--preparation by AEC of a detailed environmental statement after consultation by AEC with other Federal agencies and solicitation of comments from appropriate State and local agencies, section 102(2)(C)--Petitioners would have AEC's determination to suspend construction "occur <u>before</u> the detailed environmental statement has been prepared". Brief for Petitioners, p. 2L (emphasis added). This would turn NEPA's statutory framework upside down. Petitioners would also have AEC's determination as to suspension be made on the basis of an

evidentiary hearing at which the views of "environmentalists" would be presented but not the considered judgments of those Federal and State environmental control agencies which NEPA enjoins AEC to consider.

Petitioners cite four cases which they imply stand for the proposition that work on projects begun prior to January 1, 1970 should be halted until there has been full compliance with NEPA.17/ Brief for Petitioners, pp. 19-20. An examination of these cases indicate that they in fact stand for very different propositions. In Sierra Club v. Laird, D. Ariz. No. CIV-70-78-TUC, (appeal filed in 9th Cir.), the preliminary injunction issued on June 23, 1970 does not state the date on which the channel clearing work on the Gila River began. The complaint, Paragraphs XII-XIII, specifically states that the invitation for bids on the contract to perform this work was issued by the Corps of Engineers on April 29, 1970, that bids were opened on May 20, 1970, and that the contract was awarded the same day. Furthermore, the Corps of Engineers had not taken any steps to comply with NEPA.

17/ But see Pennsylvania Environmental Council, Inc. v. Bartlett, 315 F. Supp. 238 (M.D. Pa. 1970); Investment Syndicates, Inc. v. Richmond, 1 BNA Envir. Rptr. 1713 (D. Ore. October 27, 1970); Brooks v. Volpe, 2 BNA Envir. Rptr. 1004 (W.D. Wash., September 25, 1970), which hold NEPA inapplicable to Federal actions taking place before January 1, 1970.

In Wilderness Society v. Hickel, 1 BNA Envir. Rptr. 1335 (D.D.C. 1970), the Court enjoined the issuance of permits to construct the Trans-Alaska pipeline. Obviously, neither the permits were issued nor work started under the permits before January 1, 1970. Furthermore, the Court found that there had been no compliance with NEPA as to the most important phase of the activities for which permits were sought--the pipeline itself.

In Texas Committee on Natural Resources v. United States, 1 BNA Envir. Rptr. 1303 (W.D. Tex. 1970), the Court issued an order pending appeal enjoining the Farmers Home Administration from paying out a loan for an uncommenced park project. No steps had been taken by FHA to comply with NEPA. The Court aptly summarized the status of the enjoined project

> "Not one federal dollar has been expended toward this project, not one step of actual construction has been undertaken." Id.

The action was subsequently dismissed after trial. An appeal from the trial court's decision was dismissed as moot. 430 F.2d 1315 (5th Cir. 1970).

Finally, in Environmental Defense Fund, Inc. v. Corps of Engineers, 2 BNA Envir. Rptr. 1173 (D.D.C. 1971), a preliminary injunction was issued to halt construction by the Corps of Engineers of the Cross-Florida Barge Canal. No action had been taken to comply with NEPA. In addition, the Court found that

plaintiffs were likely to succeed in showing that two other statutes, the Fish and Wildlife Coordination Act, 16 U.S.C. §§ 661-665, and the act which authorized the Canal, 56 Stat. 703, had not been complied with. The Court found "of great probative weight" a report from the Bureau of Sport Fisheries and Wildlife, a letter from the Secretary of the Interior and a letter from the Chairman of the Environmental Advisory Board of the Corps of Engineers, all of which "affirm the need for an in depth reevaluation of the Canal project with respect to its environmental impact." 2 BNA Envir. Rptr. at 1175. Finally, it is noteworthy that the Court, without specifying to which statutes it was referring, stated that

> "the Court is doubtful that all of the statutes cited by plaintiffs support their position." Id.

It should be clear that these cases have no application to the instant situation. First, unlike the agency inaction in each of these cases, AEC is complying with the requirements of NEPA, and doing so in an orderly fashion. Second, unlike all but the Cross-Florida Barge Canal case, construction in this case had commenced well before NEPA's enactment. Third, unlike the Cross-Florida Barge Canal case, the cognizant environmental control agencies have specifically approved the project rather than calling for its "in depth reevaluation."

II. AEC Has Acted Reasonably in Implementing NEPA With Respect to Facilities Whose Construction Permits Were Issued Before January 1, 1970.

The National Environmental Policy Act places considerable authority in the hands of Federal agencies to determine the manner in which the agencies are to carry out their responsibilities under NEPA. Congress' declaration of national policy, Section 101(a) of NEPA, is not phrased in absolute terms. Rather it states that it is the Federal Government's policy

> "to use all practicable means and measures"

to carry out a national environmental policy. To carry out this policy, Federal agencies must balance environmental considerations against other important national goals. Section 101(b) states,

> "In order to carry out the policy set forth in this Act, it is the continuing responsibility of the Federal Government to use <u>all practicable means, consistent with other essential considerations of national policy</u>, to improve and coordinate Federal plans, functions, programs, and resources . . . ."
> (Addendum I, p. A1) (emphasis added).

Similarly, in creating "action-forcing" procedures, NEPA does not command the impossible. Section 102 states, "The Congress authorizes and directs that, to the fullest extent possible" Federal agencies shall undertake certain actions (emphasis added). While the underscored language was not intended to be an escape clause, it does indicate that Congress intended to create discretion in the implementation of NEPA. Ely v. Velde, 2 BNA Envir. Rptr. 1185 (E.D. Va. 1971).

This discretion was recognized by the President when he issued Executive Order 11514, "Protection and Enhancement of Environmental Quality", 35 Fed. Reg. 4247 (1970). Federal agencies were directed to create the methods by which NEPA was to be implemented.

> "Agencies shall develop programs and measures to protect and enhance environmental quality and shall assess progress in meeting the specific objectives of such activities." Section 2(a). (emphasis added).

The Council on Environmental Quality, created by Title II of NEPA, was given the authority to evaluate existing agency policies and activities, determine the need for new policies for dealing with environmental problems, and to issue guidelines to federal agencies for the preparation of detailed environmental statements. Executive Order 11514, Sections 3(a), (c), (h).

Pursuant to the mandate of NEPA and Executive Order 11514, the Council has provided guidance to Federal agencies. None of this guidance has included any suggestion of the kind of procedure which is the subject of this action. Rather, the Council has recommended the kind of orderly procedure which AEC has in fact adopted. The Council has also recognized that the primary responsibility for developing these procedures rests with each agency. Thus, the Council's Interim Guidelines adopted on April 30, 1970, 35 Fed. Reg. 7390, require each agency to establish its own formal procedures. Interim Guidelines, para. 3.

With respect to programs and projects which were in existence on January 1, 1970, the Guidelines do not even hint at Petitioners' show cause procedure. Paragraph 11 provides:

> "Application of section 102(2)(C) procedure to existing projects and programs. To the fullest extent possible the section 102(2)(C) procedure should be applied to further major Federal actions having a significant effect on the environment even though they arise from projects or programs initiated prior to enactment of [NEPA] on January 1, 1970. Where it is not practicable to reassess the basic course of action, it is still important that further incremental major actions be shaped so as to minimize adverse environmental consequences. It is also important in further

action that account be taken of environmental consequences not fully evaluated at the outset of the project or program."

Thus, Paragraph 11 suggests that the detailed environmental statement procedure of Section 102(2)(C) of NEPA be applied to "further major Federal actions" occurring after January 1, 1970 and that these major Federal actions be shaped to minimize adverse environmental consequences."

The AEC has followed the discretion vested in it by NEPA and the guidance provided by the Council on Environmental Quality in establishing procedures for those nuclear power plants whose construction permits were issued before January 1, 1970 (the date NEPA became law) and which have not yet received operating licenses.[18/] For this group of plants, AEC's regulations implementing NEPA, 10 CFR Part 50, Appendix D, J.A. I, 5, contain the following specific requirements:

1. That the holder of the construction permit submit to AEC "as soon as practicable" an Environmental Report

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18/ The Atomic Energy Act of 1954, 42 U.S.C. § 2011 *et seq.*, establishes a two-step procedure for the licensing of nuclear power plants and other production or utilization facilities. Initially, the Applicant must secure a permit to construct the facility. Upon completion of the facility, an operating license must then be obtained. Sections 182, 185, 42 U.S.C. §§ 2232, 2235.

with respect to the environmental impact of the licensed facility. (Appendix D, § 1) (J.A. I, 9). Upon receipt of the Environmental Report the AEC's Director of Regulation or his designee must analyze the report and prepare a draft Detailed Statement of environmental considerations. (Appendix D § 3) (J.A. I, 9).19/

2. That the AEC then transmit a copy of both the Environmental Report and AEC's draft Detailed Statement to appropriate Federal agencies having jurisdiction by law or special expertise with respect to any environmental impact involved, or which are authorized to develop environmental standards with a request for comment on the Environmental Report and the draft Detailed Statement. (Appendix D § 3) (J.A. I, 9).

19/ Contrary to Petitioners' assertions, Brief for Petitioners, pp.15-16, Appendix D does not require the "immediate submission of environmental reports" or the "immediate preparation of the detailed environmental statement."

3. That the Commission publish in the Federal Register a notice of the availability of the Environmental Report and the draft Detailed Statement with a request for comments from State and local agencies of any affected State which are authorized to develop and enforce environmental standards. Copies of the Environmental Report and the draft Detailed Statement together with the comments of Federal agencies thereon are to be supplied to such State and local agencies upon request. (Appendix D § 4) (J.A. I, 9).

4. That upon receipt of the comments from Federal, State and local agencies the AEC's Director of Regulation or his designee prepare a final Detailed Statement, including, where appropriate, a discussion of problems and objections raised by such agencies and the disposition thereof. (Appendix D § 5) (J.A. I, 9).

5. That copies of the Environmental Report, the draft Detailed Statement,

the comments of Federal, State and local agencies, and the final Detailed Statement be made available to the public. (Appendix D § 7) (J.A. I, 9).

6. That any party to a proceeding for the issuance of an operating license may raise as an issue in the proceeding whether or not the issuance of the license would be likely to result in a significant, adverse effect on the environment. (Appendix D § 11(a)) (J.A. I, 10).

   In such event the Atomic Safety and Licensing Board conducting the hearing in the proceeding will make findings of fact on, and resolve, the matters in controversy among the parties with respect to environmental issues. Depending on the resolution of those issues, the license may be granted, denied, or appropriately conditioned to protect environmental issues. (Appendix D § 12) (J.A. I, 10).

7. That there will be added to construction permits issued before January 1, 1970 (and all other construction permits and operating licenses), a condition that the licensee shall observe all validly imposed Federal and State standards and requirements for the protection of the environment which are determined by the Commission to be applicable to the licensed facility. This condition does not apply to radiological effects since these effects are specifically covered by other provisions of the construction permit and subsequent operating license. Nor does the condition extend to matters of water quality covered by Section 21(b) of the Federal Water Pollution Control Act since the requirements of Section 21(b) supersede the more general requirements of NEPA. (Appendix D § 9) (J.A. I, 9). As to such latter requirements Appendix D requires the inclusion in existing construction permits (as well as all

> other construction permits and operating licenses), a separate condition that the licensee shall comply with all applicable requirements of Section 21(b) of the Federal Water Pollution Control Act. (Appendix D § 14) (J.A. I, 10).

As the above requirements of Appendix D indicate, AEC has established an orderly, coherent procedure for adapting NEPA to those facilities which do not yet have operating licenses but whose construction permits were issued before January 1, 1970. Appendix D will assure that environmental considerations are fully considered in the manner anticipated by NEPA.

Under general principles of administrative law, the AEC and the Council on Environmental Quality have the discretion to decide how NEPA should be implemented. It is the responsibility of each agency to establish procedures for carrying out the mandates of NEPA consistent with the Guidelines of the Council on Environmental Quality. When an executive agency has the obligation to carry out the requirement of a statute, the courts have given great deference to the agency's implementing regulations. The Supreme Court has often called attention to this doctrine.

In Power Reactor Development Corp. v. International Union, 367 U.S. 396, 408 (1961), the Court stated,

> "Particularly is this respect due when

> the administrative practice at stake 'involves a contemporaneous construction of the statute by the men charged with the responsibility for setting its machinery in motion, of making the parts work efficiently and smoothly while they are yet untried and new.'"

Certainly the parts of NEPA are still "untried and new." In Udall v. Tallman, 380 U.S. 1, 16 (1965), the Court stated,

> "When faced with a problem of statutory construction, this Court shows great deference to the interpretation given the statute by the officers or agency charged with its administration."

In NLRB v. Hearst Publications, Inc., 322 U.S. 111, 131 (1944), the Court stated,

> "[W]here the question is one of specific application of a broad statutory term in a proceeding in which the agency administering the statute must determine it initially, the reviewing court's function is limited."

See also Perkins v. Matthews, ____ U.S. ____, 27 L.Ed.2d 476 (1971). There can certainly be no argument that Section 102 of NEPA is

"a broad statutory term." See also Unemployment Compensation Commission v. Aragon, 329 U.S. 143 (1946); F.C.C. v. Schreiber, 381 U.S. 279 (1965); Conley Electronics Corp. v. F.C.C., 394 F.2d 620 (10th Cir.), cert. denied 393 U.S. 858 (1968); Coakley v. Postmaster of Boston, Mass., 374 F.2d 209 (1st Cir. 1967).

Finally, it must be noted that the burden of establishing the invalidity of a regulation, in this case the procedures for applying NEPA to those facilities whose construction permits were issued before January 1, 1970, rests upon Petitioners. New York Foreign Freight F. & B. Assn. v. Federal Maritime Commission, 337 F.2d 289 (2d Cir. 1964), cert. denied, 380 U.S. 910 (1965). Not only do Petitioners have the burden of proving invalidity, but that burden is a heavy one. United States v. Ekberg, 291 F.2d 913 (8th Cir.), cert. denied, 368 U.S. 920 (1961).

The AEC and the Council on Environmental Quality clearly have the discretion to determine how compliance with NEPA shall be achieved. The method of compliance should not be disturbed unless it is unreasonable, irrational or arbitrary. The AEC's action is clearly consistent with the Council's Interim Guidelines and the proposed revised Guidelines.[20/]

20/ Revisions to the Interim Guidelines were proposed on January 22, 1971, 36 Fed. Reg. 1398. (Contrary to Petitioners' statement, Brief for Petitioners, p. 16, n. 5, these revisions have not yet been adopted.)

In considering the reasonableness of AEC's implementation of NEPA, it must also be considered that the NEPA procedures are directly analogous to those used by AEC in evaluating the radiological health and safety of proposed facilities. The applicant submits a report, the Preliminary or Final Safety Analysis Report, 10 CFR §§ 50.30-.34a, which is then reviewed by the staff and by the Advisory Committee on Reactor Safeguards, 10 CFR § 50.58. Comments are obtained from other agencies with expertise in the areas affecting radiological health and safety. The staff's safety evaluation report is prepared. Finally a public hearing before an Atomic Safety and Licensing Board occurs. In this way, the information necessary to determine whether a facility can be built and can operate while providing adequate protection to the health and safety of the public is developed, analyzed and evaluated in a logical, rational manner. If NEPA, as Petitioners assert, "amends the authorizing legislation for all federal agencies and departments to include these environmental objectives in their legislative mandates", Brief for Petitioners, p. 10, then it would seem eminently reasonable that AEC, to carry out the "new jurisdiction" conferred on it by NEPA, should follow the same procedures which it has used in carrying out its existing jurisdiction.

Certainly, one test of the reasonableness of AEC's actions in implementing NEPA is the judgment of those charged with the responsibility of overseeing agency performance. That responsibility rests with the Council on Environmental Quality. As

the Chairman of the Council recently testified, AEC has been "doing an exceptional job." Testimony of Russell E. Train before House Merchant Marine Committee, December 7, 1970, reported in BNA Environmental Reporter: 1 Current Developments 837 (December 11, 1970).

III. AEC Acted Reasonably in Not Granting Petitioners' Request That a Show Cause Order Be Issued to BG&E.

Petitioners' request to the AEC for an order to show cause relied upon 10 CFR § 2.202 as the source of AEC's authority to issue such an order. J.A. II, 51. That regulation provides,

> "(a) The Director of Regulation <u>may</u> institute a proceeding to modify, suspend, or revoke a license or for such other action as may be proper by serving on the licensee an order to show cause which will
>
> (1) Allege the violations with which the licensee is charged, or the potentially hazardous conditions or other facts <u>deemed to be sufficient ground</u> for the proposed action." (emphasis added).

As the underscored language indicates, AEC has, under its regulations, the discretion as to whether a show cause order should be issued. There is no suggestion that the Director of Regulation under any given factual situation <u>must</u> issue an order.

AEC acted in reasonable manner in not granting the petition for an order to show cause. AEC's action was soundly based upon the particular facts presented by the proceedings relating to the Calvert Cliffs Plant. As shown by Sections B.1. and B.2. of the Statement of Facts above, the environmental aspects of the Calvert Cliffs Plant have already been reviewed by those agencies which have "jurisdiction by law or special expertise with respect to" the environmental impacts with which Petitioners are concerned and also those agencies "which are authorized to develop and enforce environmental standards" for those impacts with which Petitioners are concerned. NEPA, Section 102(2)(C), (Addendum I, p. A2).

Petitioners' sole concern over the environmental effects of the Calvert Cliffs Plant has been the possible impacts associated with the intake and discharge of cooling water and the discharge of radioactive effluents. See Petition to AEC, J.A. II, 54-66. AEC is the agency with jurisdiction by law and special expertise with respect to radiological environmental effects. Atomic Energy Act of 1954, 42 U.S.C. §2011 <u>et seq</u>. AEC conducted a thorough re-review of these effects starting in January, 1968, when BG&E

filed its application for a construction permit. This review included a thorough study by the AEC regulatory staff, by the Advisory Committee on Reactor Safeguards and by other concerned Federal agencies. The culmination of this review process was a public hearing at which BG&E, AEC and intervening environmentalists, including a member of the Calvert Cliffs' Coordinating Committee, Inc., presented evidence on the radiological impact of the plant. Based upon the hearing record, the Atomic Safety and Licensing Board found that the plant would operate within a small fraction of the radiological discharge limits established by AEC and that there was no evidence on which the Board could find these limits invalid. J.A. II, 22. Maryland's state agencies have also looked into the environmental effects of the expected radiological discharges. Their conclusion is that these discharges would not constitute significant adverse environmental effects. See Department of Water Resources Permits, J.A. II, 193-4; PSC Opinion, p. 37 (Addendum I, p. A42).

With regard to the possible environmental impact of the plant on water quality, the very agencies to which AEC would turn under NEPA have either thoroughly studied the plant and found that there would be no significant adverse effect or have reviewed and approved the water quality standards to which the plant conforms. After public hearings at which environmentalists, including National Wildlife Federation and a member of the Calvert Cliffs' Coordinating Committee, Inc., appeared and presented evidence, the Maryland Department of Water Resources granted a

permit for the plant to use the water from the Chesapeake Bay for cooling purposes. J.A. II, 188. This same Department certified that there is a reasonable assurance that the Calvert Cliffs Plant would not violate Maryland's Water Quality Standards. J.A. II, 185. The Secretary of the Interior[21/] has approved these standards pursuant to Section 10 of the Federal Water Pollution Control Act, 33 U.S.C. § 1160. J.A. II, 186. Furthermore, the Department of Water Resources Permits place a continuing responsibility on BG&E to alter, reduce or cease operations of the plant at the Department's direction if the Department determines that the operation is causing or will cause unlawful impairment of water quality or damage to Maryland's water resources. J.A. II, 192. The Public Service Commission, after thorough study and a public hearing <u>at which environmentalists intervened and presented evidence</u>, found that there would be no significant adverse effect on water quality. PSC Opinion, p. 38 (Addendum I, p. A43).

Under NEPA, AEC is entitled to rely upon the determinations of Federal and state agencies such as the ones which have already considered appropriate water quality standards for the Calvert Cliffs Plant. The specific language of Section 102(2)(C) contemplates that AEC is to look to the standard setting agencies,

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21/ The functions of the Secretary of the Interior under the Federal Water Pollution Control Act have been transferred to the Environmental Protection Agency. Reorganization Plan No. 3 of 1970. These functions are now exercised through the Federal Water Quality Administration.

in this case, the Department of Water Resources and the Federal Water Quality Administration. NEPA's legislative history makes plain that "environmental impact" agencies such as AEC were to look to the "environmental control" agencies. As Senator Edmund Muskie stated,

> "Of course this legislation does not impose a responsibility or an obligation on these environmental-impact agencies to make final decisions with respect to the nature and extent of the environmental impact of their activities. Rather than performing self-policing functions, I understand that the nature and extent of the impact will be determined by the environmental control agencies."
> 115 Cong. Rec. S17460 (daily ed. December 20, 1969).

The only reported case dealing with this question specifically held that the Federal agency undertaking the action need not undertake independent environmental studies, but could rely on the investigations and determinations of state agencies. Pennsylvania Environmental Council, Inc. v. Bartlett, 315 F. Supp. 238, 249 (M.D. Pa. 1970).

With respect to water quality, Congress clearly intended

that the water quality certification requirements of Section 21(b)[22/] of the Federal Water Pollution Control Act would supersede the more general requirements of NEPA. The section analysis of NEPA prepared by the Conference Committee made this intent quite clear.

> "There are existing statutes and there may in the future be new statutes which prescribe specific criteria or standards of quality for environmental indicators, or which prescribe certain procedures for coordination or consultation with State or other Federal agencies, or <u>which require recommendations or certification of other Federal agencies as a prerequisite to certain actions. It is not the intent of sections 102 or 103 of this Act [NEPA] to substitute less specific requirements for those which are established concerning particular actions or agencies</u>.

22/ Added by the Water Quality Improvement Act of 1970, P.L.91-224, 84 Stat. 91. Section 21(b) basically requires that an applicant for a Federal license to conduct an activity which may result in a discharge into navigable waters must, before receiving that license, obtain a certification from the State that there is reasonable assurance that applicable water quality standards will not be violated. As discussed above, Maryland has federally approved water quality standards and BG&E has received a certification from the appropriate agency of the State of Maryland that there is reasonable assurance that the Calvert Cliffs Plant will not violate Maryland's water quality standards.

> It is the intention that where there is no more effective procedure already established, the procedure of this act will be followed. In any event, no agency may substitute the procedures outlined in this Act for more restrictive and specific procedures established by law governing its activities."
> 115 Cong. Rec. S17455 (daily ed. December 20, 1969). (emphasis added).

The respective sponsors of NEPA and the Water Quality Improvement Act specifically incorporated this interpretation into the legislative history for both acts. Senator Henry Jackson stated:

> "Section 16(c) [now section 21(b)] of S. 7 [the bill which became Water Quality Improvement Act] would have the effect of exempting the Corps of Engineers, the Atomic Energy Commission, and some other agencies from the requirement in S. 1075 [NEPA] for a detailed statement on the environmental impact of proposed actions involving any discharge into the navigable waters of the United States."
> 115 Cong. Rec. S12114 (daily ed. October 8, 1969).

Senator Edmund Muskie stated,

> "It should be clear that nothing in subsection 21(b) [of the Water Quality Improvement Act] should be interpreted as discharging Federal licensing or permitting agencies from complying with the provisions [of NEPA] <u>as far as they relate to any environmental impact not associated with water quality standards</u>." 116 Cong. Rec. S4401 (daily ed. March 24, 1970) (emphasis added).

In determining whether or not to issue an order to show cause, AEC could also look to the independent environmental studies on the Calvert Cliffs Plant which had been conducted by the Governor's Task Force on Nuclear Power Plants and the Study Panel on Nuclear Power Plants of the Maryland Academy of Sciences. These studies concluded that the Calvert Cliffs Plant would not pose a threat to the environment. See Statement of Facts, Section B.3. above. Based upon these expert evaluations alone, AEC acted reasonably in not granting Petitioners' request for a show cause order.

The primary justification alleged by Petitioners for a show cause order is that continued construction during the "full investigation of adverse environmental effects" which Petitioners claim has yet to occur, would effectively foreclose or drastically

reduce alternatives "to the plant location, design and operation." Brief for Petitioners, pp. 18, 26. Petitioners position again ignores the extensive reviews which the Calvert Cliffs Plant has already had, including thorough consideration of the alternatives.

As to the alternative of halting construction of the plant or not building it, the Public Service Commission heard evidence as to the need for power and concluded,

> "Without the facility at Calvert Cliffs [BG&E] in 1973 would have essentially a zero reserve capacity and in 1974 the load during peak is estimated to exceed the capacity by 336 megawatts (or by minus 8.3 percent)." PSC Opinion, p. 31 (Addendum I, p. A36).

The Public Service Commission also considered the availability of power from other utilities with whom BG&E is interconnected, but found that

> "each member company [of the Pennsylvania-Jersey-Maryland System] is obligated to provide its share of generation. Moreover, there is no assurance that other units depended upon by the PJM System starting with 1973 will be in service or that some of those now in service may not experience unanticipated outages." PSC Opinion, p. 32 (Addendum I, p. A37).

As to the alternative of relocating the plant, this ignores the substantial length of time that this project has been under way. The site was purchased in 1966. AEC's Draft Detailed Statement, p. 1 ____ Cert. Rec. ____. The supplier of the nuclear steam supply system and the architect-engineer were selected in 1967. PSC Opinion, p. 3 (Addendum I, p. A8). The sheer size and complexity of the plant as of December 18, 1969, June 23, 1970, November 6, 1970, and March 6, 1971, is graphically illustrated in the photographs on pages A56-58 of Addendum I. A photograph showing the Calvert Cliffs Plant site as of October 6, 1970, is included in BG&E's Environmental Report, Figure 2.5-3 (Addendum II, p. 44), 6 Cert. Rec. 2838. As of December 31, 1970, BG&E had spent over $124 million on the plant. Addendum I, p. A55. The construction period for Unit 1 of the plant is four years and for Unit 2, five years. Thus, relocation at this stage would necessarily deprive BG&E and its customers of the electricity which the Calvert Cliffs Plant would provide.

With regard to alternate means of cooling the plant, a number of possible alternatives exist--wet cooling towers, dry cooling towers and artificial cooling ponds. All of these alternatives were thoroughly discussed and evaluated in BG&E's Environmental Report (Addendum II, pp. 53-58), 6 Cert. Rec. 2838; in AEC's Draft Detailed Statement, p. 20, ____ Cert. Rec. ____; in the Governor's Task Force Report, pp. 23-25, 47-51; in the Report to the Maryland Academy of Sciences, p. 22; and

in the PSC Opinion, p. 7 (Addendum I, p. A12). The conclusion of each of these was that none of the possible alternatives were feasible.

If Petitioners have information about feasible alternatives, rather than academic theories, they should provide this information to AEC which could then consider it in the preparation of its detailed environmental statement. It is not necessary to convene a formal hearing on Petitioners' show cause request to accomplish this objective.

As this Court has recently recognized, Nader v. Federal Aviation Administration, No. 24616 (D.C. Cir., March 4, 1971), AEC need not grant Petitioners' request just because they have suggested the possibility that a hazard may exist.

> "The Administrator is given some power to measure the suggested hazard. The Administrator has done that measuring in this case, and we cannot say that his measurements are unreasonable." Slip opinion at 5.

Petitioners can only suggest that significant adverse environmental effects might be caused by the Calvert Cliffs Plant.

They cannot point to any state agency or independent scientific body which has concluded that the plant is likely to cause significant adverse effects. They concede that the plant has been the subject of numerous studies by state and Federal authorities as well as by BG&E and has received an "impressive list of permits", Brief for Petitioners, pp. 21-22 Petitioners are presumably aware of the testimony of the Director of the Chesapeake Biological Laboratory and that of the Director of the Chesapeake Bay Institute that there is a better basis for assessing the possible effects of the discharge of waste heat and low level operation radioactive wastes into the Chesapeake Bay than probably exists for any other marine environment along the coasts of this country. PSC Opinion,pp. 23-4 (Addendum I,pp. A28-9).

Based on this record alone, AEC is completely justified in not granting Petitioners' request for an order to show cause. In fact, granting such an order in the face of this record would constitute a clear abuse of discretion. Rather than take such an unwarranted step, AEC decided to proceed in an orderly fashion, developing information on the plant's potential environmental effects after consultation with cognizant governmental agencies, and extending the opportunity for a public hearing after AEC review and before the plant is licensed to operate.

CONCLUSION

For the reasons stated above, the Petition of the Calvert Cliffs' Coordinating Committee, Inc., National Wildlife Federation and the Sierra Club should be denied.

Respectfully submitted,

SHAW, PITTMAN, POTTS,
TROWBRIDGE & MADDEN
Counsel for Intervenor

By George F. Trowbridge
George F. Trowbridge

March 22, 1971

CERTIFICATE OF SERVICE

I hereby certify that copies of the Brief for Intervenor were served on the following by mailing copies to them, postage prepaid, this 22nd day of March, 1971.

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INTERVENOR'S ADDENDUM I

Table of Contents

		Page
1.	National Environmental Policy Act of 1969	1
2.	Opinion of the Public Service Commission of Maryland, Case No. 6394, January 19, 1971, "In the Matter of the Application of Baltimore Gas and Electric Company for a Certificate of Public Convenience and Necessity for the Construction of a Nuclear Power Plant near Lusby, Calvert County, Maryland."	6
3.	Excerpt from "Nuclear Power Plants in Maryland," A Report by the Governor's Task Force on Nuclear Power Plants (December 1969)	49
4.	Affidavit of John W. Gore, Jr.	54

Public Law 91-190
91st Congress, S. 1075
January 1, 1970

An Act

83 STAT. 852

To establish a national policy for the environment, to provide for the establishment of a Council on Environmental Quality, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Environmental Policy Act of 1969". National Environmental Policy Act of 1969.

PURPOSE

Sec. 2. The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

TITLE I

DECLARATION OF NATIONAL ENVIRONMENTAL POLICY

Sec. 101. (a) The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans. Policies and goals.

(b) In order to carry out the policy set forth in this Act, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may—

(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

(2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

(3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

(4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;

(5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

(c) The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.

Administration.

SEC. 102. The Congress authorizes and directs that, to the fullest extent possible: (1) the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal Government shall—

(A) utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment;

(B) identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations;

(C) include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on—

(i) the environmental impact of the proposed action,

(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,

(iii) alternatives to the proposed action,

(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Copies of statements, etc.; availability.

81 Stat. 54.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by section 552 of title 5, United States Code, and shall accompany the proposal through the existing agency review processes;

(D) study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources;

(E) recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment;

(F) make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining, and enhancing the quality of the environment;

(G) initiate and utilize ecological information in the planning and development of resource-oriented projects; and

(H) assist the Council on Environmental Quality established by title II of this Act.

SEC. 103. All agencies of the Federal Government shall review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determining whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this Act and shall propose to the President not later than July 1, 1971, such measures as may be necessary to bring their authority and policies into conformity with the intent, purposes, and procedures set forth in this Act. Review.

SEC. 104. Nothing in Section 102 or 103 shall in any way affect the specific statutory obligations of any Federal agency (1) to comply with criteria or standards of environmental quality, (2) to coordinate or consult with any other Federal or State agency, or (3) to act, or refrain from acting contingent upon the recommendations or certification of any other Federal or State agency.

SEC. 105. The policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies.

TITLE II

COUNCIL ON ENVIRONMENTAL QUALITY

SEC. 201. The President shall transmit to the Congress annually beginning July 1, 1970, an Environmental Quality Report (hereinafter referred to as the "report") which shall set forth (1) the status and condition of the major natural, manmade, or altered environmental classes of the Nation, including, but not limited to, the air, the aquatic, including marine, estuarine, and fresh water, and the terrestrial environment, including, but not limited to, the forest, dryland, wetland, range, urban, suburban, and rural environment; (2) current and foreseeable trends in the quality, management and utilization of such environments and the effects of those trends on the social, economic, and other requirements of the Nation; (3) the adequacy of available natural resources for fulfilling human and economic requirements of the Nation in the light of expected population pressures; (4) a review of the programs and activities (including regulatory activities) of the Federal Government, the State and local governments, and nongovernmental entities or individuals, with particular reference to their effect on the environment and on the conservation, development and utilization of natural resources; and (5) a program for remedying the deficiencies of existing programs and activities, together with recommendations for legislation. Report to Congress.

SEC. 202. There is created in the Executive Office of the President a Council on Environmental Quality (hereinafter referred to as the "Council"). The Council shall be composed of three members who shall be appointed by the President to serve at his pleasure, by and with the advice and consent of the Senate. The President shall designate one of the members of the Council to serve as Chairman. Each member shall be a person who, as a result of his training, experience, and attainments, is exceptionally well qualified to analyze and interpret environmental trends and information of all kinds; to appraise programs and activities of the Federal Government in the light of the policy set forth in title I of this Act; to be conscious of and responsive to the scientific, economic, social, esthetic, and cultural needs and interests of the Nation; and to formulate and recommend national policies to promote the improvement of the quality of the environment. Council on Environmental Quality.

SEC. 203. The Council may employ such officers and employees as may be necessary to carry out its functions under this Act. In addition, the Council may employ and fix the compensation of such experts and consultants as may be necessary for the carrying out of its functions under this Act, in accordance with section 3109 of title 5, United States Code (but without regard to the last sentence thereof).

80 Stat. 416.
Duties and functions.

SEC. 204. It shall be the duty and function of the Council—

(1) to assist and advise the President in the preparation of the Environmental Quality Report required by section 201;

(2) to gather timely and authoritative information concerning the conditions and trends in the quality of the environment both current and prospective, to analyze and interpret such information for the purpose of determining whether such conditions and trends are interfering, or are likely to interfere, with the achievement of the policy set forth in title I of this Act, and to compile and submit to the President studies relating to such conditions and trends;

(3) to review and appraise the various programs and activities of the Federal Government in the light of the policy set forth in title I of this Act for the purpose of determining the extent to which such programs and activities are contributing to the achievement of such policy, and to make recommendations to the President with respect thereto;

(4) to develop and recommend to the President national policies to foster and promote the improvement of environmental quality to meet the conservation, social, economic, health, and other requirements and goals of the Nation;

(5) to conduct investigations, studies, surveys, research, and analyses relating to ecological systems and environmental quality;

(6) to document and define changes in the natural environment, including the plant and animal systems, and to accumulate necessary data and other information for a continuing analysis of these changes or trends and an interpretation of their underlying causes;

(7) to report at least once each year to the President on the state and condition of the environment; and

(8) to make and furnish such studies, reports thereon, and recommendations with respect to matters of policy and legislation as the President may request.

SEC. 205. In exercising its powers, functions, and duties under this Act, the Council shall—

(1) consult with the Citizens' Advisory Committee on Environmental Quality established by Executive Order numbered 11472, dated May 29, 1969, and with such representatives of science, industry, agriculture, labor, conservation organizations, State and local governments and other groups, as it deems advisable; and

34 F. R. 8693.

(2) utilize, to the fullest extent possible, the services, facilities, and information (including statistical information) of public and private agencies and organizations, and individuals, in order that duplication of effort and expense may be avoided, thus assuring that the Council's activities will not unnecessarily overlap or conflict with similar activities authorized by law and performed by established agencies.

SEC. 206. Members of the Council shall serve full time and the Chairman of the Council shall be compensated at the rate provided for Level II of the Executive Schedule Pay Rates (5 U.S.C. 5313). The other members of the Council shall be compensated at the rate provided for Level IV or the Executive Schedule Pay Rates (5 U.S.C. 5315). Tenure and compensation. 80 Stat. 460, 461. 81 Stat. 638.

SEC. 207. There are authorized to be appropriated to carry out the provisions of this Act not to exceed $300,000 for fiscal year 1970, $700,000 for fiscal year 1971, and $1,000,000 for each fiscal year thereafter. Appropriations.

Approved January 1, 1970.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 91-378, 91-378, pt. 2, accompanying H. R. 12549 (Comm. on Merchant Marine & Fisheries) and 91-765 (Comm. of Conference).
SENATE REPORT No. 91-296 (Comm. on Interior & Insular Affairs).
CONGRESSIONAL RECORD, Vol. 115 (1969):
July 10: Considered and passed Senate.
Sept. 23: Considered and passed House, amended, in lieu of H. R. 12549.
Oct. 8: Senate disagreed to House amendments; agreed to conference.
Dec. 20: Senate agreed to conference report.
Dec. 22: House agreed to conference report.

PUBLIC SERVICE COMMISSION
OF MARYLAND

OPINION

IN THE MATTER OF THE APPLICATION OF BALTIMORE GAS AND ELECTRIC COMPANY FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR THE CONSTRUCTION OF A NUCLEAR POWER PLANT NEAR LUSBY, CALVERT COUNTY, MARYLAND.	* * * *	BEFORE THE PUBLIC SERVICE COMMISSION OF MARYLAND CASE NO. 6394

Appearances:

James A. Biddison, Jr., Esquire
William L. Marbury, Esquire
W. Robert Buchanan, Esquire
David A. Harkness, Esquire
Counsel for Baltimore Gas and Electric Company

J. William Hinkel, Esquire
People's Counsel

J. Frank Boyd, Esquire
Counsel for the County Commissioners of Calvert County

James C. Cawood, Jr., Esquire
Counsel for Frank R. and Calpurnia S. Carter and the Chesapeake Environmental Protection Association, Inc.

J. Cookman Boyd, Jr., Esquire
Counsel for the Chamber of Commerce of Metropolitan Baltimore

Joyce M. Hill
In Proper Person

January 19, 1971

By the Commission.

HISTORICAL BACKGROUND

The application of Baltimore Gas and Electric Company (hereinafter sometimes referred to as "Company" or "Applicant") was filed pursuant to Section 54A of The Public Service Commission Law, (Article 78, Annotated Code of Maryland, 1969 Replacement Volume) which Section became effective July 1, 1968 and reads as follows:

"No electric company may begin the construction in Maryland of a generating station or any overhead transmission line designed to carry a voltage in excess of 69,000 volts, or exercise the right of eminent domain in connection therewith, without having first obtained from the Commission a certificate of public convenience and necessity for the construction of the station or line. The Commission shall hold a public hearing on each application for a certificate of public convenience and necessity in the area in which any portion of the construction of a generating station or an overhead transmission line designed to carry a voltage in excess of 69,000 volts is proposed to be located, together with the local governing bodies of each such area, unless any governing body wishes not to participate in the hearing. The Commission shall take final action only after due consideration of the recommendations of such governing bodies, the need to meet present and future demands for service, effect on system stability and reliability, economics, esthetics, historic sites, and, when applicable, the effect on air and water pollution. The said public hearing shall be advertised in a newspaper of general circulation in the area affected once in each of the two successive weeks immediately prior to the hearing."

For some time the proposed plant has been the subject of considerable public interest and regulatory and legal proceedings. It, therefore, seems appropriate in our consideration of this application to review briefly prior proceedings before the Commission involving this plant so as to place the matter in proper perspective.

On May 28, 1969, People's Counsel petitioned the Commission to require the Company to apply for a Certificate of Public Convenience and Necessity under the provisions of Section 54A of The Public Service Commission Law for the construction of a nuclear power plant at Calvert Cliffs, Calvert County, Maryland. Hearings were held on this petition, the sole issue before the Commission being whether or not construction within the meaning of Section 54A was begun prior to July 1, 1968. If construction had begun prior to that date, the Company would not be required to seek a Certificate from the Commission.

At the hearing the Company produced testimony that (a) in December 1966 it agreed to buy from General Electric Company a $25,000,000 turbine generator; (b) in May 1967 it signed a memorandum of understanding with Combustion Engineering, Inc. for construction of the proposed plant's nuclear steam supply system; (c) about a week later the deed to the site was delivered; (d) three days later the Company made a public announcement of its intent to construct a two-unit nuclear power plant at Calvert Cliffs; (e) immediately thereafter the Company caused to be drilled core borings in the earth of the proposed site to determine the composition and utility of the ground; (f) in June 1967 the Company ordered a second generator from Westinghouse Electric Company at a price of $25,000,000; (g) on July 31, 1967 the Company hired Bechtel Corporation (Bechtel) to provide services for engineering and construction for the Calvert Cliffs nuclear power plant; (h) in August 1967 certain seismological studies at the site were contracted for; (i) in December 1967 Bechtel prepared a bar chart showing excavation scheduled for June 1968, and in February 1968 a master flow chart that also estimated that excavation would begin in June 1968; (j) in January 1968 the Company sought and received from Calvert County a permit to "construct a metal shed" on land adjacent to the site to use in testing condensor tubes; (k) later in January 1968 the Company filed with the Atomic Energy Commission an application for a permit to construct the nuclear generating station; (l) lumber companies cut marketable timber in February 1968; (m) in April 1968 C. J. Langenfelder & Sons, Inc. began clearing and grubbing operations; (n) on June 6, 1968 Langenfelder began to move earth in order to level the site to an elevation of Plus 1.

The Commission considered that this activity constituted the beginning of construction prior to the effective date of the law and, accordingly, by

its Order No. 57778, entered July 31, 1969, denied the petition of People's Counsel.

The Commission's decision was affirmed on appeal by the Circuit Court for Anne Arundel County. However, the Court of Appeals of Maryland determined, in a 5 to 2 opinion filed October 23, 1970, that construction had not begun prior to July 1, 1968, within the meaning of Section 54A, and remanded the case to the Commission for further proceedings. By Per Curiam opinion filed October 30, 1970, the Court declined to give an advisory opinion to the Company interpreting its decision filed on October 23, 1970. The Court did say, however, that the Commission should hold the hearing and make its determination as soon as reasonably possible and that the Company should facilitate the fastest progress reasonable under the circumstances.

Thereafter the Company on November 2, 1970, filed an application for a Certificate of Public Convenience and Necessity for the construction of the nuclear power plant at Calvert Cliffs, Calvert County, Maryland. The Commission on November 4, 1970, after public hearing issued an Order directing the Company to stop construction of the nuclear power plant by the close of business on November 6, 1970 (except for construction necessary to prevent an unsafe or hazardous condition from existing at the plant site). The "stop-work" decision of the Commission was appealed by the Company to the Circuit Court for Calvert County, and after hearing on November 6, 1970 the Court stayed the order of the Commission pendent lite until such time as the Commission should hold hearings and render a decision on the application filed by the Company for a Certificate of Public Convenience and Necessity for the nuclear power plant.

PARTICIPANTS AND PARTIES

Pursuant to the provisions of Section 54A, the County Commissioners of Calvert County (the local governing body) participated in the hearing and was represented each day by one or more of its members or its Counsel. Counsel for the Calvert County Commissioners also called several witnesses who gave testimony.

In addition to the Applicant, People's Counsel entered his appearance and participated on behalf of the public generally throughout the proceeding. Chesapeake Environmental Protection Association, Inc. and Frank R. and Calpurnia S. Carter (CEPA) were permitted to intervene and were represented by Counsel. Other intervenors were the Chamber of Commerce of Metropolitan Baltimore by Counsel and Mrs. Joyce M. Hill, individually.

TESTIMONY OF THE WITNESSES

Witnesses for the Applicant

John E. Taulbee, Treasurer, Baltimore Gas and Electric Company.

Mr. Taulbee testified that the present estimated cost of the two-unit nuclear power plant is approximately $347,000,000. This includes $1,585,000 for the cost of land, $300,000,000 for the cost of the plant and an estimated $45,000,000 of interest to be capitalized during construction. He also testified that the estimated annual effect of the project on the Company's operating expenses, maintenance expenses, depreciation expense and taxes other than income taxes would total approximately $23,412,400. Of this total

$3,212,400 is for operating expenses, $2,700,000 for maintenance expenses, $10,300,000 for depreciation expense, and $7,200,000 for taxes other than income taxes. In addition, there will be an estimated annual fuel cost of about $17,000,000.

John W. Gore, Jr., Vice President for Engineering and Construction, Baltimore Gas and Electric Company.

Mr. Gore's responsibilities encompass the planning, engineering, design and construction of the major elements of the electric system for the Applicant. In this capacity he has overall responsibility for the Calvert Cliffs project.

Mr. Gore described the plant site as occupying approximately 100 acres of a total of 1,135 acres owned by the Company at that location. According to this witness the plant is designed for two units, each with a nominal output of 800 megawatts. He described the nature of the nuclear steam supply system, stating that the Bay water used for cooling never comes in contact with the nuclear fuel. The reactor itself will use fresh water from wells drilled on the Company's property. However, he stated that from the Radwaste System minute amounts of radioactive substances will be discharged into the Bay when the activity is low enough to meet the requirements of the water permit issued by the Department of Water Resources. This will be a controlled release and will be monitored. The maximum annual design discharge would be 14 times the volume of the primary loop of approximately 11,000 cubic feet of water. The witness said that it is illegal to transport radioactive liquids over highways. He also said that the radioactivity levels are monitored continuously by instrument within the plant and by records that will be made of those levels.

The witness stated that the Atomic Energy Commission (AEC), the State Department of Water Resources and the State Department of Health will maintain continuous surveillance over the activity of the plant.

Mr. Gore then testified that the nuclear fuel will be fabricated in the form of ceramic pellets of uranium dioxide approximately ½ inch to 1 inch long but less than ½ inch in diameter and loaded into fuel tubes about ½ inch in diameter and 12 feet long. These tubes will be constructed of zircalloy, and Mr. Gore said that there had been some years of experience with a number of reactors using this type of tube without serious adverse effects. The tube will be installed inside the nuclear reactor vessel and the core structure.

The fuel will be enriched by the United States Atomic Energy Commission. The witness stated that he did not visualize any shortage in the availability of nuclear fuel for the Calvert Cliffs plant. Mr. Gore also said that the spent fuel would be reprocessed in South Carolina under a contract and the useable fuel recovered would be reused in the fuel cycle.

He discussed the function of cooling towers and said that their use at the Calvert Cliffs site was not practical. The principal reason for this conclusion was that 210 tons of salt per day would be sprayed over the surrounding terrain from the cooling towers.

Mr. Gore further testified that the plant site was not visible from State Routes 2 or 4. He said that architecturally the plant is low profile in that the structures with relation to the surrounding natural elements did not stand out unduly. It was also his testimony that there are two designated historic sites located on the 1,135-acre tract occupied by the plant site. One

is known as Parran's Park and is just off Route 2-4; the other is known as Preston's Cliffs and is near the construction area. Mr. Gore said that both of these former residences are in a total state of disrepair and that the Company had fenced them in to prevent any further vandalism or injury to the curious by climbing through the dilapidated structures. The next nearest historic site is about two miles away and the plant is not visible from that site.

Fred Stern, employed by Combustion Engineering, Inc. and assigned as Project Manager for the Calvert Cliffs project.

Combustion Engineering is a firm that carries on diversified activities but the main products of its utility division are power plant boilers and nuclear reactors for power plants.

Mr. Stern testified that the Calvert Cliffs plant will use zircalloy clad fuel rods. He said that zircalloy has been the most frequently used material for cladding fuel rods in nuclear electric generating plants. He also said that to his knowledge the use of zircalloy clad fuel rods has not caused any problems with reference to health aspects in the event of fuel failure nor has the use of zircalloy caused any failures in fuel rods. The witness also stated that he did not know of a better type of fuel element than the zircalloy clad fuel element.

William L. Ridenhour, Manager of the Electric Systems Planning Department of Baltimore Gas and Electric Company.

Mr. Ridenhour testified that the Calvert Cliffs plant will have a capacity of about 845 megawatts in 1973, about 1,710 megawatts in 1974 when

the second unit is scheduled to begin operations and about 1,730 megawatts in 1975. According to this witness the present installed generating capacity of the Company is approximately 3,000 megawatts so that each of the Calvert Cliffs units represents about 28 percent of this present capacity. He said that the capacity of the Calvert Cliffs plant was urgently needed to supply customers in the year 1973 and thereafter. He also said that without the first unit in 1973 the Applicant's reserve capacity would be essentially zero and that in 1974 the peak load would exceed the capacity. Mr. Ridenhour stated that during the past summer the reserve was approximately 9.6 percent. He further testified that the Applicant planned to sell 500 megawatts in 1974 to Potomac Electric Power Company, leaving a reserve of 21.5 percent. According to Mr. Ridenhour the increase in the Company's load during 1968 and 1969 averaged 12 percent. He also said that a 20-percent reserve capacity was desirable.

Mr. Ridenhour further testified that extensive and detailed studies had been made of the stability of the Calvert Cliffs plant which demonstrated that the plant will be stable and will not go out of step with other units. The plant with its associated transmission line has been determined by the Mid-Atlantic Area Coordination Group to meet the reliability standards of that organization. Mr. Ridenhour further testified that the reliability of the Company's system and of the interconnected P J M System will be increased because the reserve of generation over the expected load will be increased.

With respect to other studies, Mr. Ridenhour testified that the most significant economic factor to be considered in this case is the cost of fuel. In this connection he said that nuclear fuel is much cheaper per unit of electrical output than any known fossil fuel. At the present time he reported

a cost for nuclear fuel of 2.09 mills per kilowatt hour and a cost of 5 mills for oil. No 1970 cost comparison was furnished for low sulfur coal since, according to the witness, it was not available in the quantities needed. The witness said that the cost to build the nuclear plant is about $100,000,000 higher than a fossil fueled plant, but that the annual operating costs which result from the use of nuclear fuel are about $30,000,000 lower than for a comparable fossil fueled plant, which far outweighs the higher annual carrying charges associated with the nuclear plant. Mr. Ridenhour then testified that studies had indicated that the most economic plan was to construct a nuclear plant. He also said that the Company believed that the cost of low sulfur coal and low sulfur oil would increase over the years more rapidly than the cost of nuclear fuel.

Morton I. Goldman, Vice President and General Manager of the Environmental Safeguards Division of NUS, a firm providing consulting engineering and scientific services to the utility industry.

Dr. Goldman testified that since early 1967 his firm has been employed to assist with certain nuclear problems in connection with the design of the Calvert Cliffs plant. He said that 99.9999 percent of the radionucleids, with the exception of tritium, are removed from the water in the primary coolant system after treatment so that .0001 percent is discharged ultimately into the Bay. He also stated that if this liquid waste were removed from the plant by tank truck, it would require each day between three and five integral tank trucks surrounded by absorbent material capable of absorbing at least twice the volume contained in the inner tank and the entire tank truck would have to

be buried because no burial site in the United States will accept this loose liquid for disposal in the ground.

Dr. Goldman also testified that by comparison the 99.9999 percent of the radionucleids that are removed from the water in the primary cooling system would be solidified at the site, packaged in containers and shipped by truck to approved burial sites. He estimated that there would probably be two to three truckloads per year of small drums, equivalent in size to 50-gallon oil drums, involved in these shipments. The witness further said that the present level of radioactivity in the Bay from natural sources, and in the case of tritium from weapons test fall off, is about 300 picocuries per milliliter and that the maximum discharge into the Bay from the primary coolant system under the water permit is 10 picocuries per milliliter or 1/30th of what is naturally present. The expected discharge is 1½ picocuries per milliliter. According to Dr. Goldman there will be a monitoring program at the location of the discharge in the Bay but since a discharge in the Ocean could not be monitored effectively it is not now permitted by the AEC. He stated that it is safer to discharge the diluted material into the Bay than to risk transportation by barge or truck of the undiluted waste material.

With respect to the release of radioactive gases the witness said that some amount was vented to the atmosphere but that it was so small it was unmeasurable and would not create any problem with respect to health, safety or welfare of the general public or of the workers in the plant. He also said that none of the several processes under development to reduce or eliminate this discharge had progressed to a stage where they could be considered feasible for installation in the Calvert Cliffs plant.

George H. Cobb, Senior Vice President, Kerr-McGee Corporation, a firm concerned with natural resources, primarily in energy fuels which include oil, gas, coal and uranium.

Mr. Cobb testified that his firm is the largest domestic miner and miller of uranium ore for sale to the Atomic Energy Commission and that it also makes private sales to utilities. He stated that the uranium reserves in the United States at the end of 1969 totalled 204,000 tons of U308. This, he said, was an increase from the 140,000 tons of reserves in 1966. Mr. Cobb testified that he did not visualize any real scarcity in uranium reserves or the amount of uranium which could be mined in the future. He said that the AEC estimated that the reserve of 204,000 tons of U308, which is related to a price of about $8.00 a pound, would be about 250,000 tons at a price of $10.00 a pound. He also said that, in addition, estimates of the potential reserves at $10.00 a pound were 600,000 tons of U308. In further testimony Mr. Cobb said that through the year 1985 the commercial requirements within the United States will be 443,000 tons. It was the view of this witness that with all of the unexplored potential in the country, the past performance under the AEC program and the present performance under the domestic market, there is no reason why U308 will not be available in quantities of this nature over an extended period of time.

Gerard C. Gambs, Director of Special Projects for Ford, Bacon and Davis, a consulting engineering firm with offices in New York City.

Mr. Gambs testified that he specializes in the energy field and energy studies. He concluded that there is an inadequate supply of low-sulfur coal, an inadequate supply of low-sulfur oil, and that this situation will continue for a number of years. He said that the only solution to the problem is to

turn as rapidly as possible to nuclear fuel. Mr. Gambs said, by comparing production with consumption, that for coal there would be a deficit of about 20,000,000 tons in 1970, that there was a deficit of 7,000,000 tons in 1969 and another deficit of about 5,000,000 tons in 1968. He stated that most of the uncommitted coal reserves were west of the Mississippi.

According to Mr. Gambs there are no commercial installations of sulfur dioxide removal systems in operation at the present time that would permit the use of high-sulfur coal and still meet the air quality standards imposed on generating plants in the State of Maryland. He said that there are several plants in the country being fitted out with sulfur dioxide removal systems but that the plants involved are of a 500 megawatt capacity. The witness said that it will be several years before it is known whether or not these systems work.

With respect to oil for the generation of electricity, Mr. Gambs said that the situation was very serious from both a residual oil standpoint and a crude oil standpoint. According to the witness a total of about 14,000,000 barrels a day are being used. Nine million barrels are produced in this country, another one and one-half million barrels come out of gas and liquid, and the remaining three and one-half million barrels are imported. The imported oil is basically residual fuel and comes mostly from Venezuela. About one-third of the oil we obtain from Venezuela comes from the Middle East. He said that the oil must be desulfurized to a certain point so that it can be recombined with a low-sulfur oil to obtain a low-sulfur residual. This oil is burned by utilities in areas where a 0.5 sulfur fuel oil is required. Mr. Gambs said there is an insufficient quantity of this low-sulfur oil and that further delays in nuclear plant start-ups will create a worse crisis in oil supply than is

being experienced this year. He also testified that the United States and other major countries would become more and more dependent on oil from the Middle East and that by 1980 this country would have to rely on the Middle East for almost half of its oil supply. He said that this situation plus declining coal production was stimulating the European countries and Japan to turn to nuclear power plants.

Mr. Gambs also testified that a 1,600 megawatt generating plant (the rated capacity of Calvert Cliffs) would require 4,000,000 tons of coal a year or 16,000,000 barrels of oil a year, which when related to the requirements for a 30-year period as to coal indicated 120,000,000 tons or a reserve of 240,000,000 tons. A block of this size, he said, is not available in the Eastern United States. Nor would coal gasification solve the problem according to this witness.

Werner P. Chernock, Director of the Nuclear Laboratories of Combustion Engineers.

Mr. Chernock testified that of the 20 reactors that are or have operated, 16 use zircalloy cladding for the fuel rods. He also said that by 1973 there are 25 additional reactors scheduled and they will all use zircalloy cladding. In addition, he said that fuel on nuclear submarines is clad with zircalloy. Mr. Chernock stated that in his opinion the fuel which Combustion Engineering is supplying for the Calvert Cliffs plant will last for its designed lifetime.

Witnesses for the
County Commissioners of Calvert County

Ray M. Jones, Executive Director of the Calvert County Economic Development Corporation.

Dr. Jones said that the public services and facilities in Calvert County have traditionally been inadequate and have lagged behind most other areas of Maryland. He testified that the location and development of the nuclear power plant in Calvert County was significant in the economic development of the region in terms of the availability of a large number of construction job opportunities and increases in tax revenues to provide modern public facilities and services. He urged that there be no delay in the construction program.

Paul Kernan, engaged in the real estate business in Calvert County.

Mr. Kernan supported the position of Dr. Jones and said he believed the Bay would be perfectly safe and not affected by the nuclear power plant.

Witnesses for the
Chamber of Commerce of Metropolitan Baltimore

Herbert G. Bailey, Jr., Executive Vice President, Chamber of Commerce of Metropolitan Baltimore.

Mr. Bailey testified that the Chamber was deeply concerned that Metropolitan Baltimore may be moving into an era when electrical power will be in dangerously short supply. In this connection a report was submitted that

had been prepared by the Chamber's staff economist. The conclusions reached in the report were: (1) growth on Applicant's system is faster than the national average and to 1975 total demand will probably compound at the rate of 9 percent annually; (2) market demand will overtake plant capacity after 1972, and by the end of 1975 the metropolitan service area will be short over 700 megawatts unless Calvert Cliffs comes on as scheduled; (3) that even with Calvert Cliffs, demand overtakes supply by 1978 unless additional capacity is installed; (4) that power shortages will cause the loss of approximately 30,000 new jobs through 1975 based on conservative estimates; (5) that these job losses would affect every facet of the area's economy and by 1975 deprive the retail industry of $135,000,000 in new business annually, retard the service industry by $95,000,000 per year and cause reduced annual taxes of $13,000,000 for the State of Maryland and local governments; and (6) cause firms considering plant locations in mid-Maryland to locate elsewhere. The witness urged the completion of the Calvert Cliffs nuclear plant on schedule and stressed the independence of the Chamber's report and investigation from testimony presented by the Company witnesses.

Jack D. Englar also testified for the Chamber and answered several clarifying questions with respect to the report.

Witnesses for CEPA

Edward P. Radford, Professor of Environmental Medicine at Johns Hopkins School of Hygiene and Public Health.

Dr. Radford testified that there is no evidence that the tritium that will be released within the limits set by the Department of Water Resources

will have adverse effects on the organisms in the Bay. Dr. Radford expressed doubt as to whether fuel reprocessing plants would be capable of reprocessing the nuclear fuel used by present and prospective nuclear plants and, if not, concluded that it would be necessary to shut down the Calvert Cliffs facility. It was brought out that Maryland is the only state that prohibits the storage or burial of nuclear waste. Dr. Radford also said that in his judgment the Calvert Cliffs plant will only operate at a 50 percent reliability after taking into account (1) the possibility or probability that at the time of peak demand of this plant it will have to be partially shut down in order to meet the thermal requirements of the Water Resources permit, (2) the fact that the general reliability of nuclear power plants has not been as good up to now as the conventional fossil fueled plants and (3) the question as to whether there will be an opportunity to reprocess the fuel.

William L. Ridenhour, an earlier witness for the Applicant, was recalled as a witness for CEPA.

Through this witness an exhibit was entered into evidence which consisted of certain cost estimates made by the Applicant in connection with reaching a decision to construct a nuclear plant rather than a non-nuclear plant. It was also brought out that the average carrying charge on the capital investment at Calvert Cliffs is 4.48 mills per kilowatt hour, that the average insurance is 0.15 mills per kilowatt hour and that operation and maintenance would average 0.37 mills per kilowatt hour.

Carleton Ray, an Associate Professor in the School of Hygiene and Public Health of Johns Hopkins, specializing in marine ecology.

Dr. Ray testified that based on his knowledge and a review of studies conducted by several scientific groups and of the permit issued by the Maryland Department of Water Resources, he thought it was necessary to point out that some very serious effects could occur which could be detrimental to aquatic life even if the thermal release from the plant were within the limits set in the permit. Dr. Ray expressed the opinion that the migratory path of the young fish passes close to the plant site and said that he was concerned as to what effect the warmer water discharged from the plant would have on the migratory pathways of the young fish. Dr. Ray also expressed the view that an adverse physical effect could occur which could threaten the survival of the various types of bottom-living organisms.

Alexander Kusko of Alexander Kusko, Incorporated, Consulting Engineers.

Dr. Kusko testified that the present price structure of U-308, which is in the neighborhood of $8.00 per pound, is geared to relatively small quantities now demanded by the electric power industry. He said based on projections made by a Professor Benedict that as consumption of uranium fuel increases in the future, the price of U-308 will rise, and if the anticipated level of generation using nuclear power is reached, the price of U-308 may rise to $30.00 a pound in the year 2000.

Joseph Mullan, Director of Environmental Affairs for the National Coal Association.

Mr. Mullan testified that the known recoverable reserves of bituminous coal in the United States stand at 380,000,000,000 tons and estimated ultimate reserves of 1,605,000,000,000 tons. He said that the reserves of low-sulfur

coal in the Eastern United States are committed to or owned by the metallurgical industry. The problem with using straight coal is that it does not meet existing air quality standards. He said that progress was being made on developing equipment or processes for reducing the sulfur from the fuel itself or from the stacks. Mr. Mullan stated that the processes were being developed in order to meet air quality standards by removing the sulfur when high-sulfur coal is burned. He hoped that by the end of 1971 equipment for an 800-megawatt installation could be ordered for purchase. The witness also testified that the average price of coal in 1969 varied between 33 and 34 cents per million BTU's and that in 1970 the range is between 42 and 44 cents. By stipulation it was agreed that a nuclear power plant at Calvert Cliffs would produce 40 percent more waste heat in the circulating water than a similarly situated fossil fueled plant commensurate in size.

Witnesses Called by the Commission

William W. Eaton, who in 1969 was Chairman of the Governor's Task Force on Nuclear Power Plants.

Dr. Eaton has an extensive background in scientific fields relating to various fields of physics and engineering. At the present time he serves as Chairman of the Task Force on Nuclear Power Plant Policy set up by the Southern Governors' Conference.

Dr. Eaton cited a recommendation in the report submitted by the Governor's Task Force on Nuclear Power Plants, an exhibit in this case, which concluded that the Calvert Cliffs nuclear power plant, operating in compliance with Federal and State laws and regulations, does not in itself constitute a threat in any significant way

to the health, safety or economy of the State of Maryland or its citizens, nor will the plant seriously impair the quality of the Chesapeake Bay environment.

Dr. Eaton said that radiological discharges will be well within the established limits and described them as infinitesimal when compared to the variable natural background radiation to which man has been subjected since the beginning of time. He also said that the thermal effects will be relatively small, extremely localized and would not, in his opinion, represent a problem.

Paul W. McKee, Director of the Maryland Department of Water Resources.

Mr. McKee testified that his Department has made it clear in its permit that the Applicant will be under a continued obligation to demonstrate that the water quality is not impaired and that water resources are not damaged by the operation of the plant. He said that the Department of Water Resources, through its own staff or through efforts by others under contract to the Department, will continue careful monitoring of these operations, and insisted that such monitoring by the Department will not relieve the Company of the responsibility to perform its own monitoring and surveillance operations with complete and continuous reports to the Department.

It was Mr. McKee's opinion that the permit issued by his Department, with the conditions as indicated, will grant to the Company lawful use of the waters of the State, while at the same time protecting the best interests of the public. He said that the permit, which was issued to and accepted by the Baltimore Gas and Electric Company, is the most restrictive permit ever issued by the Department of Water Resources and may be the most restrictive in the Nation. The severe restrictions incorporated in this permit are considered

necessary in order to provide adequate protection for aquatic life and for the public safety and welfare.

In addition, Mr. McKee stated that the Department of Water Resources is fully prepared to enforce all of the restrictions and conditions of the permit. Violation of any of these restrictions, conditions or provisions of applicable law may cause the Department to revoke the permit.

Letter from J. Millard Tawes, Secretary of the Department of Natural Resources.

A letter from the Secretary of the Department of Natural Resources was received into evidence. This letter advised the Commission that the Department of Natural Resources has determined that the Calvert Cliffs nuclear power plant at Lusby, Calvert County, Maryland, will not significantly threaten or materially impair the water quality of the Chesapeake Bay provided the facility is operated in compliance with the strict standards set by Federal and State authorities. The Company is legally bound to comply with these regulations or suspend operations. The letter concludes that the power plant operated in accordance with these conditions will not constitute a hazard to the environment, the Chesapeake Bay or the general public.

Lee Zeni, Special Project Engineer of the Maryland Deparment of Natural Resources, offered himself for cross-examination on the contents of this communication.

Witnesses for People's Counsel

(At their request several witnesses were called by People's Counsel to testify, although they were not a part of his case in chief.)

Robert E. Bauman, State Senator-elect, representing the upper part of the Eastern Shore.

Mr. Bauman recommended design changes in the plant generally to eliminate the potential for any kind of environmental pollution. He urged the Commission to give the application very careful study to insure a decision consistent with the public interest.

Thomas A. Matthews, an Associate Professor in the Department of Physics and Astronomy at the University of Maryland, who specified that he appeared as an individual and not as an expert.

Dr. Matthews testified that he also had the authority to speak for the Sierra Club. It was the view of this witness that much still has to be learned about the effects of the thermal and radioactive pollution of the proposed plant on the ecology of the Chesapeake Bay. He said that there would be some effect, but it would not be known whether it was serious until the necessary biological studies have been made. It could disrupt the commercial and sport fishing in the Bay. He urged further biological studies and said that no construction on the plant should be allowed until they were made.

James A. Carpenter, an Associate Professor in the Department of Earth and Planetary Sciences at the Johns Hopkins University. He also participates

in the activities of the Chesapeake Bay Institute as a research scientist but said he was testifying as a member of the public.

Dr. Carpenter said he serves on a committee supervising studies of the discharges of waste heat from the Oyster Creek Power Plant in New Jersey. He stated that these studies have been conducted over a four-year period, and he has formed an opinion that the warming of the Chesapeake Bay associated with the quantities of heat to be produced from the Calvert Cliffs nuclear power plant will not produce observable changes in the biological populations there. Dr. Carpenter disagreed with the testimony of Dr. Ray and also said that he would not know how to prescribe the complete study urged by Dr. Matthews.

Morgan Huntington, a mining engineer who has a large number of domestic and foreign patents, including nuclear fuel patents.

Mr. Huntington said that he opposed the granting of a permit until there was assurance of absolute security against demolition of the reactor by sabotage.

Lewis Eugene Cronin, Director of the Chesapeake Biological Laboratory at Solomons, as well as Director of the Natural Resources Institute of the University of Maryland.

Dr. Cronin discussed various factors that should be considered by the Commission with respect to the operation of the plant on the Bay. He expressed the opinion that there is not sufficient information to assure that there will be no adverse effects nor sufficient information to make a reasonable prediction of all of the effects. However, he did not take a position for or against the construction of the plant. Dr. Cronin agreed with the testimony given by

Dr. Donald W. Pritchard before the Maryland Department of Water Resources on February 19, 1970 to the effect that the research programs supported by the State of Maryland have provided knowledge which provides the Natural Resources agencies of this State with a better basis for assessing the possible effects of the discharge of waste heat and low level operation radioactive wastes into the Chesapeake Bay than probably exists for any other marine environment along the coasts of this country.

John W. Gofman, Professor of Medical Physics at the University of California at Berkely and Research Associate in the Biomedical Division of the Lawrence Radiation Laboratory at Livermore.

Dr. Gofman testified that if the Calvert Cliffs plant operates within the Water Resources standards (1% of allowable AEC limits), it was his opinion that it would be grossly unsafe for the people of the State of Maryland. According to Dr. Gofman the AEC standards, and even one percent of the standards, are grossly in error because they neglect to take care of the biological concentration of a wide variety of nuclides. He said that there is no proof whatsoever that any amount of radiation is safe. He also said that a release of one percent of AEC standards at the Calvert Cliffs plant would undoubtedly have an effect in the form of an increased risk of cancer and leukemia and an effect of genetic injury that will be perpetuated in the future generations. In effect, Dr. Gofman states that because of a lack of data there are no safe standards for running a nuclear power plant and that the only proper course to follow with respect to the construction of nuclear power plants is total containment. Dr. Gofman questioned the AEC limits in general and said that for a variety of radionuclides released at a one percent limit, biological concentration processes can give

individuals well beyond the border of the plant doses that may come to or surpass the 170 millirems limit.

Adolph J. Ackerman, a consulting engineer with offices in Madison, Wisconsin.

Mr. Ackerman testified that the capacity of the Calvert Cliffs plant exceeded any other nuclear plant now in operation. He also testified that generation by nuclear power represented less than ½ of one percent of the total generating capacity in the United States. He said that since a nuclear plant must be completed before an operating license is granted by the AEC, there is a financial risk involved in constructing a nuclear facility.

David Marra, who serves with the United States Navy as head of the Descriptive Oceanography Branch, testified as an individual.

Mr. Marra testified that if anything is to be added to the environment, be it PCB or DDT, then as much as possible should be known about the present levels and the allowable control limits set for the particular region. He said that he had not seen in any literature what the background levels of radiation flowing through this area are projected to be.

Charles E. Olson, associated with the firm of Van Scoyoc and Wiskup, public utility consultants.

Dr. Olson testified that in addition to the costs of operation and maintenance of the Calvert Cliffs plant, there were "social costs" occasioned by environmental damage. Dr. Olson said that these costs are not recovered in the company's revenue requirement but that society as a whole bears these costs.

He also said that this results in under-pricing the service and, in turn, may or may not result in excessive consumption requiring the construction of facilities that otherwise may not be needed. The witness said that one thing that might be done with rate design is to reverse the block rate structure so that the more electricity used, the higher the price.

Eric David Schneider, Director of the Ocean Floor Analysis Division of the United States Naval Oceanographic Office, testified as a private citizen.

Mr. Schneider said that it was his feeling that the Calvert Cliffs plant will have to be shut down during a large period of the summer because the inflow water for cooling purposes will be higher than 80 degrees. He also said that the process of drawing water from the lower level of the Bay and discharging it at the surface would highly enrich the surface in phosphate.

Jesse W. Malcolm, who is employed by and appeared on behalf of the Chesapeake Bay Foundation.

Mr. Malcolm said that it was the Foundation's position that the proposed Calvert Cliffs nuclear power plant constitutes a potential problem of great magnitude and it would be improper for the State of Maryland not to conduct independent studies of the proposal in the public interest.

Marlene Ances, who appeared as a representative of the Women's Civic League, Inc.

Mrs. Ances read a statement into the record. The statement emphasized that the League could not find reasons for the chosen site of the Calvert

Cliffs nuclear power plant, the proposed design, or the validity of the stated safeguards against thermal pollution in the area.

Anne B. Rutledge, Environmental Quality Chairman of the League of Women Voters of Anne Arundel County.

In a brief statement Mrs. Rutledge focused attention on that portion of the permit issued by the Department of Water Resources which provides that if a final decision by a court having jurisdiction over the State holds that the AEC has preempted the right of a state to regulate such discharges, such provisions in the permit as may be in conflict shall become null and void.

E. Churchill Murray, a member of the public.

In his statement Mr. Murray said he was apprehensive because of the lack of knowledge in depth of the effect of the operation of the plant on the Bay.

Witnesses for Joyce M. Hill

Henry G. Edler, Vice President of Operations for Ambionics, a Washington, D. C. firm that principally makes studies in various fields of government.

Mr. Edler briefly discussed several ways he thought the discharge temperature of the water could be reduced.

A 3r

Alfred E. Robinson, Jr., employed by the Corps of Engineers of the United States Army.

Through Mr. Robinson the Chesapeake Bay Plan of Study prepared by the Corps of Engineers and The Advisory Group to the Chesapeake Bay Study was introduced. The purpose of the document was described as identifying some of the ecological problems that may exist in the Bay.

Lewis Battist, associated with Ambionics, Incorporated.

Dr. Battist testified that he had recently made an application for a patent on a gaseous air-borne monitoring system which, he said, was far more sensitive than any he currently knew about. At present, he said, a prototype was being built for field testing.

Everett M. Adams, a salesman for Westinghouse Electric Corporation.

This witness was not qualified to answer most of the questions asked by Mrs. Hill, and any reference to his testimony would be meaningless.

Mildred A. Stellfox, a graduate registered nurse who has done public health work.

Mrs. Stellfox said she opposed the granting of the application and expressed concern as to the adequacy of insurance applicable to nuclear power plants.

Paul Tompkins, former Director of the Federal Radiation Council, a body that was abolished on December 2, 1970 and its functions absorbed into the newly created Environmental Protection Agency.

Dr. Tompkins testified in effect that the operation of the Calvert Cliffs plant within one percent of AEC maximum permissable concentration would be safe. He also testified that the tritium concentrations that would be discharged by the plant within the limits prescribed by the permit of the Department of Water Resources would not be dangerous. Dr. Tompkins said that from the standpoint of the radioactivity releases the operation of the Calvert Cliffs plant would not harm acquatic life in the Chesapeake Bay or be harmful to the people residing in the State of Maryland. He also testified that it would not be harmful for humans to eat fish, crabs or oysters caught in the immediate vicinity of the plant after it was in operation.

Rebuttal Witness for Applicant

Frederick J. Jeffers, a Senior Engineer in the Electric Engineering Department of Baltimore Gas and Electric Company.

Mr. Jeffers testified that the Academy of Natural Sciences in Philadelphia had been retained in 1967 to plan a program of study of the Calvert Cliffs site. As a result, two large surveys are made each year in June and July to determine the abundance and diversity of the protozoa, algae, vertebrates and fish in the area. In addition, he said, monthly surveys are made to determine the plankton, the productivity and the types of fish, crabs, oysters and clams. Monthly surveys are also made of the chemical and physical properties of the water at the site. The witness said that two studies are made outside of the sphere of influence of the plant and two are within the sphere of influence. He also said that the pre-operational studies will be for a five-year period

and that similar studies are planned to continue for a five-year period if the plant is authorized to become operational. Reports are submitted annually on the results of the studies.

DISCUSSIONS, CONCLUSIONS AND FINDINGS

Under Section 54A the Commission in making its decision on the application of Baltimore Gas and Electric Company for a Certificate of Public Convenience and Necessity for the construction of a nuclear power plant at Calvert Cliffs, Calvert County, Maryland, is required to give due consideration to the following factors or elements:

(1) the recommendations of the local governing body;

(2) the need to meet present and future demands for service;

(3) the effect on system stability and reliability;

(4) economics;

(5) esthetics;

(6) historic sites; and

(7) the effect on air and water pollution.

Recommendation of the Local Governing Body

There has been filed in this proceeding a recommendation made by the Board of County Commissioners of Calvert County. This local governing body participated at each day of hearing through representation by one or more of its members and/or its counsel. The recommendation received by the Commission

from the Board of County Commissioners was most comprehensive and fully developed the basis for the following recommendation:

> ". . . the Board of County Commissioners recommends to the Public Service Commission of Maryland that it issue to the Baltimore Gas and Electric Company a Certificate of Public Convenience and Necessity for the construction of the Calvert Cliffs Generating Station."

This recommendation was signed by all three of the members who constitute the Board of County Commissioners of Calvert County.

Need to Meet Present and Future Demands for Service

The need for the facility to meet present and future demands for service was established by the Applicant. The plant will have a capacity of about 845 megawatts in 1973 when the first unit comes on line and about 1,710 megawatts in 1974 when the second unit is scheduled to begin operations. The present generating capability of the Company is about 3,000 megawatts. The Company's load has been growing during the past two years at the rate of 12 percent. Without the facility at Calvert Cliffs the Applicant in 1973 would have essentially a zero reserve capacity and in 1974 the load during peak is estimated to exceed the capacity by 336 megawatts (or by minus 8.3 percent). Parenthetically, it may be noted that an independent study submitted by the Chamber of Commerce of Metropolitan Baltimore concluded that without generation from Calvert Cliffs the metropolitan area will be short over 700 megawatts by the end of 1975. The Commission is well aware of the integrated nature of the PJM System and that the reserve capacity of the pool should be given considerable weight in assessing future reliability.

While the Company is a member of the PJM System, which group hopefully could temporarily make up the shortage if the Calvert Cliffs plant did not become operational, the fact remains that each member company is obligated to provide its share of generation. Moreover, there is no assurance that other units depended upon by the PJM System starting with 1973 will be in service or that some of those now in service may not experience unanticipated outages. Most informed sources, including this Commission, believe that a 20-percent reserve capacity is desirable. For the Company this can only be achieved by completion of the Calvert Cliffs facility.

Effect on System Stability and Reliability

Here again the evidence indicates that based on extensive and detailed studies the plant will be stable and will not go out of step with other units. In addition, the plant with its associated transmission line has been determined by the Mid-Atlantic Area Coordination Group to meet the reliability standards of that organization. Moreover, both the reliability of the Company's system and of the interconnected PJM System will be improved because the reserve of generation over the expected load will be increased. Finally, there was evidence that the larger units employed in nuclear power plants are more reliable since they operate at a lower speed than those associated with a fossil fueled plant.

Another aspect of reliability is related to the long range availability of nuclear fuel. In this connection the evidence indicated that uranium reserves in the United States totalled 204,000 tons of U-308 in 1969. This reserve is related to a price of about $8.00 a pound. According to AEC estimates this reserve would be about 250,000 tons at a price of $10.00 a pound. Additional estimates of the potential reserves at $10.00 a pound were 600,000 tons of U-308.

It was also estimated that through the year 1985 the commercial requirements within the United States will be 443,000 tons. If the potential and proven reserves at $10.00 a pound total 850,000 tons, then commercial supplies of U-308 well beyond 1985 would be available. There was further evidence that the unexplored potential should result in the availability of U-308 in sufficient quantities over an extended period of time.

The evidence also showed that the fossil fuel situation for oil was very serious. The United States uses 14,000,000 barrels a day, of which about 3,500,000 barrels are imported. By 1980 this country will become quite dependent on imported oil. Of course, the oil burned by the utilities must be desulfurized to meet air quality control standards. The availability of low-sulfur content coal in large quantities is also critical. If fossil fueled, the Calvert Cliffs plant annually would use 16,000,000 barrels of oil or 4,000,000 tons of coal. There are large reserves of high sulfur coal in the eastern part of the country, but proven equipment to remove the sulfur dioxide at the stack is not available at the present time.

Under all of the circumstances it does not appear that dependency on the availability of U-308 over an extended period of time results in too great a risk factor, particularly in view of the limited availability of low-sulfur fossil fuel. At the present time there is a restriction which limits natural gas distributing companies from adding a new customer whose usage exceeds 300 mcf. a day. Such a prohibition illustrates the shortage of natural gas as an alternate fuel. There are also indications that a coal gasification process will not be practicable as a viable alternative for a number of years.

An important aspect of our consideration of reliability relates to the design of the plant and the use of zircalloy cladding on the fuel rods. From our

review of the evidence it appears that zircalloy clad fuel rods are generally accepted and are used in the majority of the plants now in operation and their use is planned for approximately 25 reactors now scheduled to go into operation in the near future. The use of this cladding at Calvert Cliffs appears desirable.

Economics

In prior-Section 54A application cases evidence presented for consideration of economics has been confined to the economics of the plant investment and the expenses associated with its operation. Such evidence was given in this proceeding; however, evidence was also presented by the Chamber of Commerce of Metropolitan Baltimore that power shortages in the Baltimore area would cause the loss of about 30,000 new jobs through 1975. The Chamber also said that these job losses would affect every facet of the area's economy and by 1975 deprive the retail industry of $135,000,000 in new business annually, that the service industry will lose revenues of $95,000,000 per year and also cause reduced annual taxes of $13,000,000 for the State of Maryland and local governments. Calvert County offered evidence that the location of the plant in Calvert County was significant in the economic development of the region in terms of the availability of a large number of construction job opportunities and increases in tax revenues to provide modern public facilities and services. The aforementioned testimony concerning economics apart from that associated with plant investment and operational expenses was given careful consideration but little weight in reaching our decision.

Evidence was presented that nuclear fuel was cheaper per unit of electrical output than fossil fuel having a sulfur content to meet existing Maryland air quality standards. It was established that the cost to construct

the nuclear power plant at Calvert Cliffs would exceed by an estimated $100,000,000 the cost to construct a fossil fueled plant of the same capacity. However, the evidence also showed that the lower expenses of operation of the nuclear plant more than offset the higher revenues that would be required to support the additional expenditure.

An estimate was made by one witness that by the year 2000 the price of U-308 may rise to $30.00 a pound. However, another witness believed that the cost of low-sulfur coal and low-sulfur oil would increase over the years more rapidly than the cost of nuclear fuel. The fact is that in the Commission's judgment, based upon the evidence, the present cost of nuclear fuel per kilowatt hour for this plant is considerably less than the cost per kilowatt hour for low-sulfur fossil fuel.

Esthetics

There was no evidence of criticism as to the esthetics of the plant. Architecturally, it is low profile in that the structures with relation to the surrounding natural elements do not stand out unduly.

Historic Sites

With respect to historic sites it appears that aside from two former residences located on the 1,135-acre tract occupied by the plant site that are in a total state of disrepair, the nearest historic site is about two miles distant. The plant site is not visible from this historic site.

Air and Water Pollution

We come now to the effect of the plant on air and water pollution, the most controversial issue in this proceeding. Before initiating our discussion of this factor it must be recognized that this Commission is not a scientific body. Rather it is a quasi-judicial agency whose decisions by law must be decided in each case solely on the record of evidence developed at public hearings. In this particular proceeding the evidence includes the testimony of a number of highly qualified, science-oriented experts.

The Maryland Department of Water Resources Permit issued to and accepted by Baltimore Gas and Electric Company was admitted into evidence. This permit grants the Company lawful use of the waters of the State (i.e., the Bay) and, in the judgment of that Department, at the same time protects the best interest of the public. The director of the Department of Water Resources described the permit as the most restrictive permit ever issued by his Department and added that it may be the most restrictive in the Nation. The contents of the permit have made it clear that the Applicant will be under a continued obligation to demonstrate that the water quality is not impaired and water resources are not damaged by the operation of the plant. The Department of Water Resources, through its own staff or through efforts by others under contract to the Department, will continue careful monitoring of these operations. However, such monitoring by the Department will not relieve the Company of the responsibility to perform its own monitoring and surveillance operations with complete and continuous reports to the Department. Violation of any restrictions and conditions in the permit or applicable provisions of law could cause the Department to revoke the permit.

The Governor's Task Force on Nuclear Power Plants consisting of 17 members was established on July 10, 1969, and its Report, unanimously concurred in, was submitted to Governor Mandel on December 15, 1969. The Chairman of the Task Force directed attention to a recommendation in the report which reads as follows:

> "Based upon careful consideration of available evidence the task force concludes that the Calvert Cliffs Nuclear Power Plant, operating in compliance with Federal and State laws and regulations, does not in itself constitute a threat in any significant way to health, safety or economy of the State of Maryland or its citizens, nor will the plant seriously impair the quality of the Chesapeake Bay environment."

In this regard several of the scientific experts that testified expressed views that supported the conclusions of the Task Force. Others, equally eminent scientists, were of the opinion that serious effects could occur on aquatic life even if the thermal release is kept within the limits prescribed by the Department of Water Resources Permit; also, that operation of the plant even within one percent of allowable AEC limits would be grossly unsafe for the people of Maryland. The permit issued by the Department of Water Resources limits radionuclide concentrations in liquid waste discharges to the lowest practicable levels not to exceed one percent of the maximum permissible concentrations set by the AEC. The permit also limits tritium concentrations not to exceed ten picocuries per milliliter.

Several witnesses testified that there is not sufficient information to assure that there will be no adverse effects nor to make a reasonable prediction of all of the effects. On the other hand, there was testimony that research programs supported by the State of Maryland have furnished knowledge which provides the Natural Resources agencies of the State with a better basis for assessing the possible effects of the discharge of waste heat and low level

operation wastes into the Chesapeake Bay than probably exists for any other marine environment along the coasts of this country.

The evidence in the case established that the emission of radioactive gases into the atmosphere would be de minimus. Nevertheless, if any process is developed which will further reduce or eliminate this release, the Company will be required to utilize the process if feasible.

This Commission is as dedicated to the protection of the environment as any public body can be, and in light of the testimony of the many witnesses on the effect of air and water pollution we have reviewed the conditions and restrictions which were made a part of the permit issued by the Department of Water Resources to Baltimore Gas and Electric Company for the operation of the nuclear power plant at Calvert Cliffs. These conditions and restrictions are numbered one through twenty-one in the permit and in our judgment adequately cover many of the areas of concern expressed by witnesses testifying before the Commission. For example, the 10th Condition requires the Applicant to continue biological and other appropriate scientific studies of the aquatic environment and to carry out investigations and perform specified research studies. Under the 11th Condition the Company is required to conduct an environmental monitoring program. This will be in addition to the monitoring program under the Department of Water Resources.

It is our belief that the evidence in this case that bears on the effect of the operation of the Calvert Cliffs nuclear power plant on air and water pollution supports the conclusion that there will be no significant adverse effect in this regard.

Conclusions and Findings of the Commission

After due consideration of all the evidence in this case, including the evidence relating to the recommendation of the governing body of Calvert County, the need to meet present and future demands for service, the effect on system stability and reliability, economics, esthetics, historic sites, and the effect on air and water pollution, the Commission is of the opinion and so finds that the construction of the nuclear power plant at Calvert Cliffs, Calvert County, Maryland, is in the public interest and that a Certificate of Public Convenience and Necessity should be issued to Baltimore Gas and Electric Company.

Under Section 28(c) of The Public Service Commission Law public service companies, including electric companies operating generating facilities, are required to furnish facilities which are safe, adequate, just and reasonable. In addition, the Commission is authorized to prescribe standards of service which will best promote the security or convenience of the public and may enforce the standards set by it and may by order require such changes and additions in the service of any public service company as it may deem necessary, including but not limited to repairs or improvements in plant.

In connection with the granting of the Certificate of Public Convenience and Necessity the Commission will require of the Company compliance with the following conditions:

1. The Public Service Commission will retain jurisdiction over the design of the plant, as well as its operation, and will require the backfitting of technological advancements, as they become available, that provide reasonable additional protection necessary for the public health and safety or protection of the environment.

2. The plant will be operated in strict accordance with all applicable laws and regulations, including the operating license to be issued by the Atomic Energy Commission and the permit issued by the Maryland Department of Water Resources.

3. The radioactive waste processing system will be operated to maintain radioactive discharges into the air and water at the lowest possible level. Back-fitting shall be required as new techniques or improved processes are developed which can feasibly be incorporated into the design of the plant.

4. The Company shall on a continuing bases promptly furnish the Commission with copies of reports made by and for the Company bearing on (a) the ecology of the Chesapeake Bay, (b) the effect of the operation of the Calvert Cliffs plant on the environment, and (c) technological improvements in the construction and operation of generating facilities.

5. No less than 90 days before the plant, or any component part thereof, shall become operational for the generation of electric energy, the Company shall so inform the Commission.

In granting a Certificate of Public Convenience and Necessity for the construction of a nuclear power plant at Calvert Cliffs, it is not to be deemed that the Commission is setting a precedent for the construction of additional nuclear power plants. In this regard each application must stand on its own and action thereon by the Commission will not be influenced by the existence of the Calvert Cliffs plant, although knowledge gained by its operation will unquestionably be of assistance in evaluating any future plans for constructing generating stations of this type.

An appropriate order will be entered.

PUBLIC SERVICE COMMISSION

OF MARYLAND

ORDER NO. 59203

IN THE MATTER OF THE APPLICATION OF BALTIMORE GAS AND ELECTRIC COMPANY FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR THE CONSTRUCTION OF A NUCLEAR POWER PLANT NEAR LUSBY, CALVERT COUNTY, MARYLAND.	BEFORE THE PUBLIC SERVICE COMMISSION OF MARYLAND CASE NO. 6394

In accordance with the Opinion of the Commission filed herein on the date hereof, which Opinion is hereby referred to and made a part hereof, it is, this 19th day of January, in the year Nineteen Hundred and Seventy-one, by the Public Service Commission of Maryland,

ORDERED: That a Certificate of Public Convenience and Necessity be, and it is hereby, granted to Baltimore Gas and Electric Company for the construction of a Nuclear Power Plant, having a nominal output of 1,600 megawatts, near Lusby, Calvert County, Maryland, as applied for in this proceeding, subject to the following conditions:

1. The Public Service Commission will retain jurisdiction over the design of the plant, as well as its operation, and will require the backfitting of technological advancements as they become available, that provide reasonable additional protection, necessary for the public health and safety or protection of the environment.

2. The plant will be operated in strict accordance with all applicable laws and regulations, including the operating license to be issued by the Atomic Energy Commission and the permit issued by the Maryland Department of Water Resources.

3. The radioactive waste processing system will be operated to maintain radioactive discharges into the air and water at the lowest possible level. Backfitting shall be required as new techniques or approved procedures are developed which can feasibly be incorporated into the design of the plant.

4. Baltimore Gas and Electric Company shall on a continuing

PUBLIC SERVICE COMMISSION

OF MARYLAND

basis promptly furnish the Commission with copies of reports made by and for the Company bearing on (a) the ecology of the Chesapeake Bay, (b) the effect of the operation of the Calvert Cliffs plant on the environment, and (c) technological improvements in the construction and operation of generating facilities.

5. No less than 90 days before the plant, or any component part thereof shall become operational for the generation of electric energy, Baltimore Gas and Electric Company shall in writing so inform the Commission.

William O. Doub

Charles E. Edmondson

H. Reese Shoemaker, Jr.

Commissioners

Form No. 4

State of Maryland
Office of Public Service Commission } ss.

The preceding copy has been compared with the original

ORDER NO. 59203 - IN THE MATTER OF THE APPLICATION OF BALTIMORE GAS AND ELECTRIC COMPANY FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR THE CONSTRUCTION OF A NUCLEAR POWER PLANT NEAR LUSBY, CALVERT COUNTY, MARYLAND - CASE NO. 6394.

on file in this office and I do HEREBY CERTIFY the same to be a correct transcript therefrom and of the whole thereof.

Witness, my hand and the Seal of Office of the Public Service Commission, at the city of Baltimore, this 19th *day of* January *one thousand nine hundred and* Seventy-one.

[signature]
Secretary.

"NUCLEAR POWER PLANTS IN MARYLAND,"

A Report by the

Governor's Task Force on Nuclear Power Plants

(December 1969)

Excerpt from Section II, Conclusions and Recommendations

Pages 6-8

D. Based upon careful consideration of available evidence, the Task Force concludes that the Calvert Cliffs Nuclear Power Plant, operating in compliance with Federal and State Laws and Regulations, does not in itself constitute a threat in any significant way to the health, safety, or economy of the State of Maryland or its citizens, nor will the plant seriously impair the quality of the Chesapeake Bay environment.

There are a number of considerations which lead to the above conclusion. They are described in detail in Section IV of this report but are summarized below.

1. Thermal Effects

There are major drawbacks in the use of cooling towers or artificial lakes for dissipating the heat generated by the Calvert Cliffs power plant. On the other hand, the large quantity of new fresh and salt water flowing in the Calvert Cliffs region of the Chesapeake Bay make it an appropriate reservoir

for receiving and carrying off the waste heat from the plant site. A detailed analysis of the temperature increase in the Bay produced by this waste heat is given in Section IVA and also in Appendix D.

The results of this thermal analysis show that the water temperature at the point of discharge will be no more than 10 degrees higher than the intake temperature (and by law, never more than 90 degrees F), and the increase will drop off rapidly so that the area of Chesapeake Bay surface having temperature increases of 3 degrees F or greater is 23 acres (less than 1/20th of a square mile). Less than 10% of the width of the Bay off the site will have a surface temperature rise of 1 degree F or more; the average temperature rise in this tidal segment will be 0.4 degrees F. These temperature increases will occur between the surface and depths of 20 feet; the temperatures at the bottom will be virtually unchanged.

The waste heat release conditions and the accompanying temperatures satisfy all Federal and State requirements. In addition, this average temperature rise of 0.4 degrees occurs in an area where the water temperature normally varies over 50 degrees F throughout the year, over 5 degrees F for the average temperature from year to year, and over 3 degrees F within a 10-mile length along the Bay. In view of this, it is concluded that the effects on aquatic life will be very small.

2. Radioactive Effects

The last column in Table 1 of Section IIID tabulates the maximum permissible calculated concentration of various radionuclides in sea water, while Table I in Section IVB shows what these concentrations would be in the discharge water for the Calvert Cliffs plant before any dilution in the Bay and under the most pessimistic operating conditions. In both cases, the assumptions have been extremely conservative. Despite this, the radioactive discharge from the proposed Calvert Cliffs plant is shown to be well within permissible safe limits and far less than the maximum values specified by governmental authority.

Expressed in terms of total annual radiation dose, the Federal Radiation Council has specified 170 millirem (.17 rem) as an acceptable radiation risk for an average person, compatible with the benefits of the peaceful uses of radiation. This compares with 5000 millirem as a permissible dose for radiation workers, and 100 to 150 millirem as the annual background radiation dose which a person receives by virtue of the fact that he is alive and living in Maryland. The whole body radiation dose which the Calvert Cliffs plant will add to an individual living at the site boundary and eating only seafood is considerably less than 1 millirem per year.

Tritium is the radioactive isotope about which the public has been most concerned, and the Task Force has given careful attention to its presence, its quantity, and its possible

effects. Tritium will be in the water discharged to the Bay, in larger quantities than any other radioactive isotope. Its effect, however, will be only about 1/30,000th of natural background radiation referred to in the previous paragraph.

The Task Force concludes that, compared with the maximum permissible concentrations that have been established for health and safety reasons, the postulated releases of radioactivity from the Calvert Cliffs plant pose a minor hazard. Yet recognizing that any radioactivity in the environment is undesirable, the Task Force believes that continued reduction of radioactive releases should be a first priority activity with all nuclear power plant designers and operators, and with the governmental authorities which regulate them.

3. <u>Safety</u>

The Task Force believes that adequate safeguards have been incorporated in the design and operating procedures so that there is no public hazard. This is amplified in Section IVD.

4. <u>Intake, Discharge, and Chemical Effects</u>

Intake structures and discharge structures are potentially detrimental if improperly designed. The State Department of Water Resources should recognize this and should require an adequate design with intake and discharge velocity so small that

Existing State regulations and legislative controls have established routine "good housekeeping" procedures which limit chemical discharges so that they do not constitute a hazard, as long as safety procedures are maintained and controlled.

AFFIDAVIT OF JOHN W. GORE, JR.

STATE OF MARYLAND:
: SS:
CITY OF BALTIMORE:

1. I, JOHN W. GORE, JR., am Vice President-Engineering and Construction of Baltimore Gas and Electric Company and I have personal knowledge of the matters set forth herein.

2. The expenditures listed on Table 1 attached to this Affidavit accurately represent the expenditures actually made by Baltimore Gas and Electric Company for the Calvert Cliffs Nuclear Power Plant, as of the dates shown thereon.

3. The photographs attached to this Affidavit as Exhibits A, B, C, and D fairly and accurately represent the status of construction at the Calvert Cliffs Nuclear Power Plant site as of December 18, 1969, June 23, 1970, November 6, 1970, and March 6, 1971, respectively.

John W. Gore, Jr.
John W. Gore, Jr.

Subscribed and sworn to before me, the subscriber, a Notary Public of the State of Maryland, in and for the City of Baltimore, this 18th day of March, 1971.

Miriam C. Jamney
Notary Public

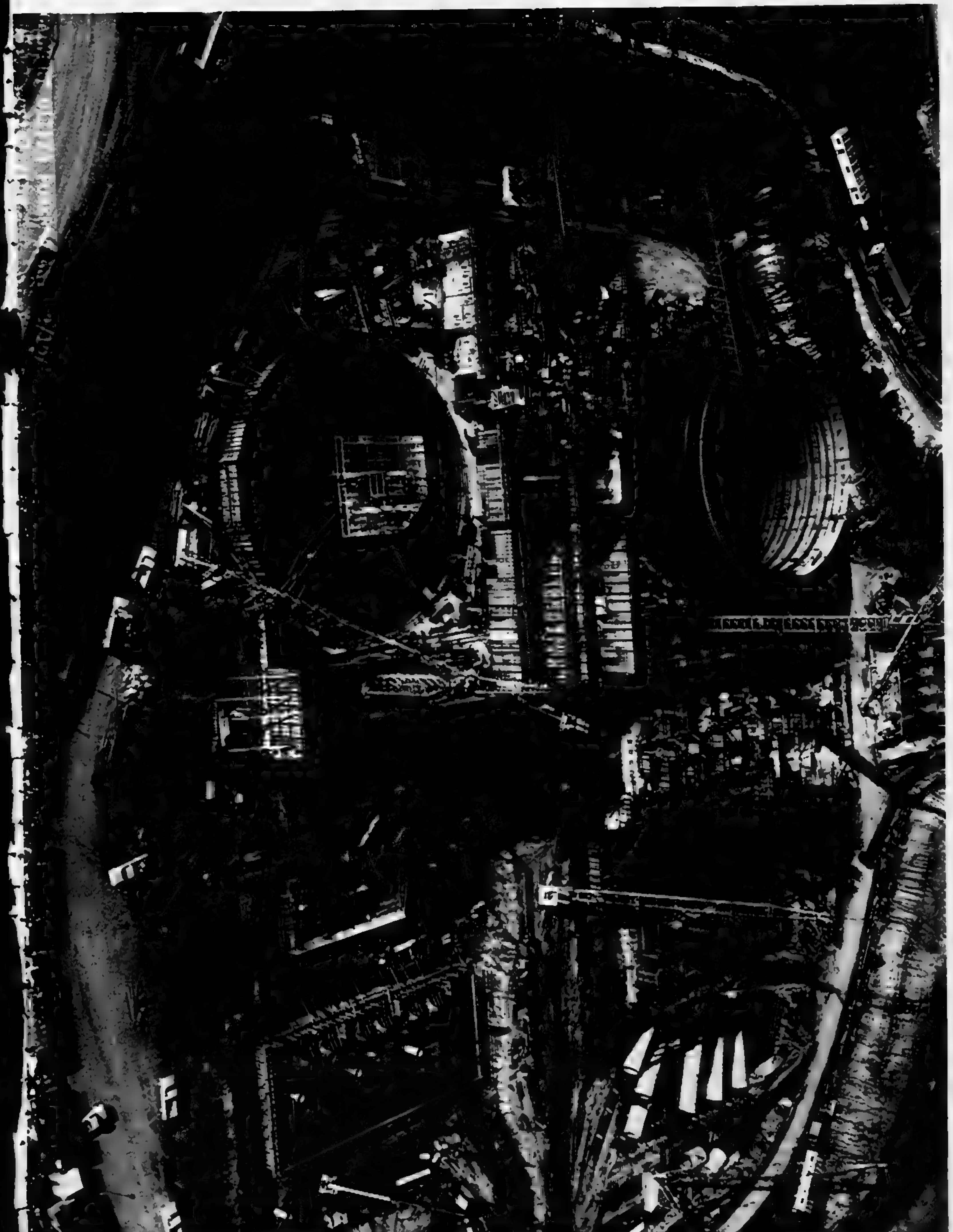
TABLE 1

Expenditures
Calvert Cliffs Nuclear Power Plant
Units No. 1 and 2

	All Costs Except Nuclear Steam Supply Systems*	Nuclear Steam Supply Systems (Progress Payments)	Total All Costs
	Cumulative	Cumulative	Cumulative
1968			
Up to & Thru 2nd Q	1,966,000	4,950,000	6,916,000
3rd Q	4,108,000	6,600,000	10,708,000
4th Q	6,786,000	9,819,000	16,605,000
1969			
1st Q	9,019,000	13,042,000	22,061,000
2nd Q	12,758,000	16,302,000	29,060,000
3rd Q	19,181,000	19,573,000	38,754,000
4th Q	27,513,000	22,860,000	50,373,000
1970			
1st Q	34,997,000	26,157,000	61,154,000
2nd Q	46,864,000	29,490,000	76,354,000
3rd Q	64,183,000	32,832,000	97,015,000
4th Q	88,179,000	36,175,000	124,354,000

* Nearly all of these costs represent engineering, on-site construction work, and delivered equipment.

Exhibit #

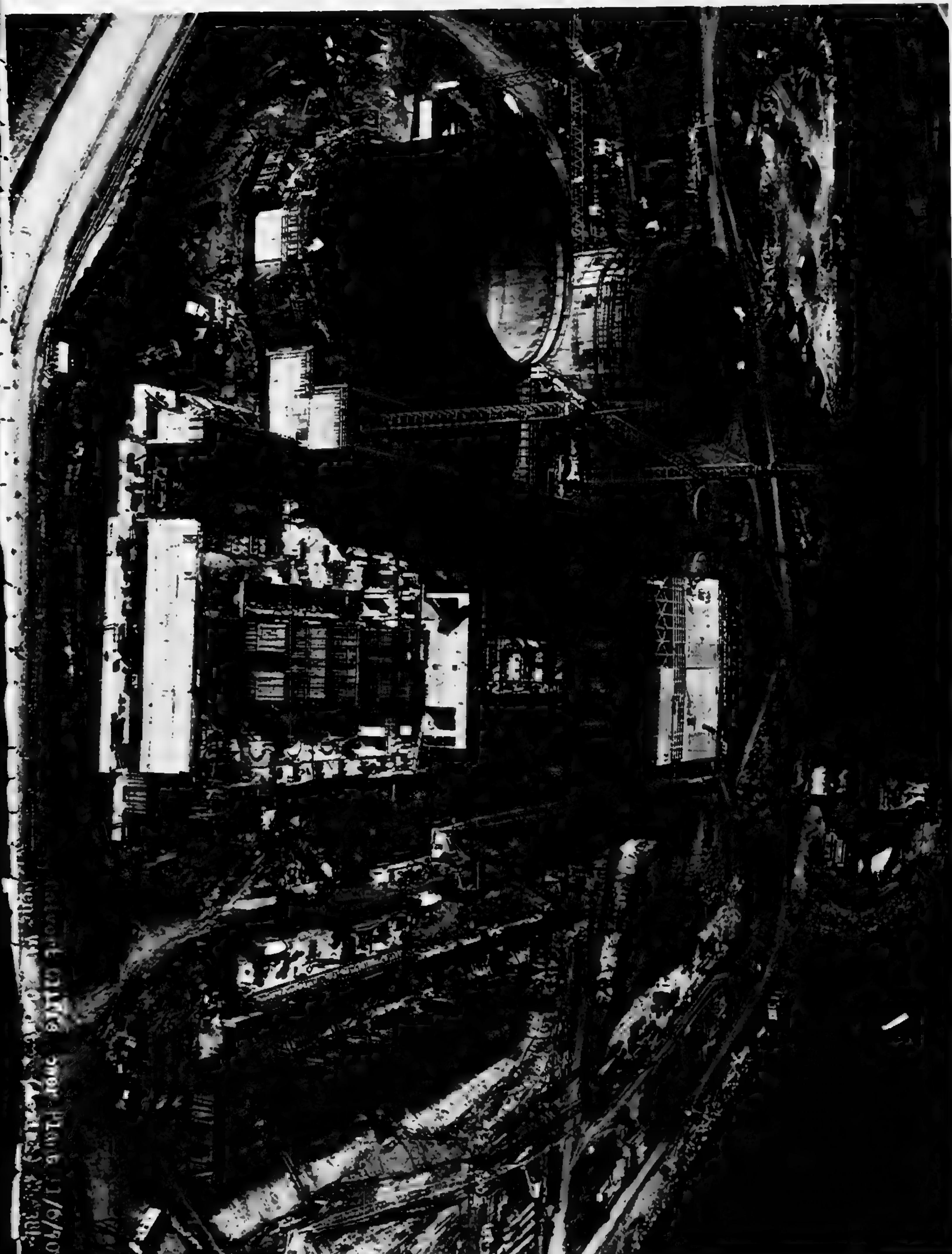


A56

Exhibit B

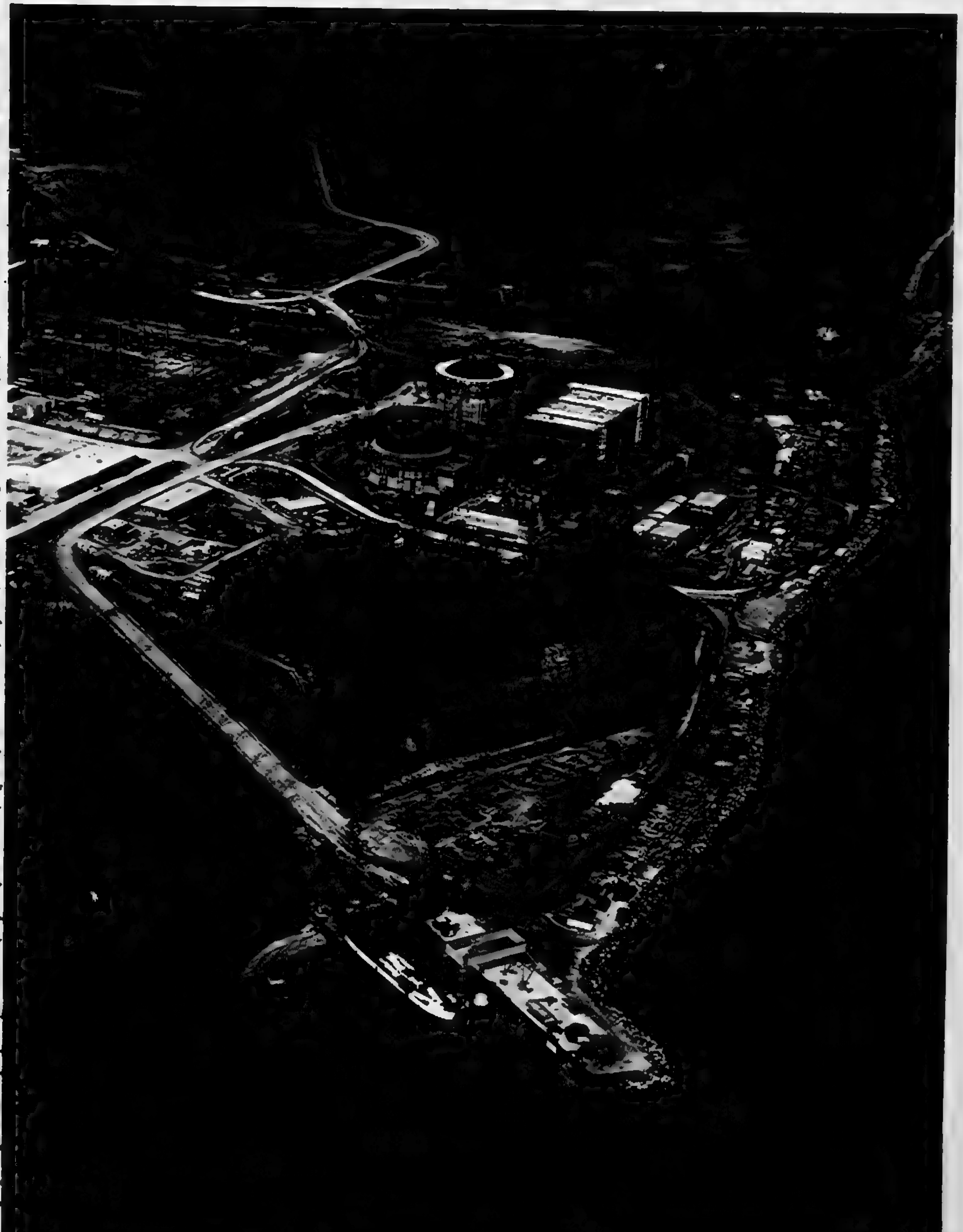
A57

Exhibit C



A58

Exhibit D



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254

BRIEF FOR THE RESPONDENTS

IN THE

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

No. 24,839

CALVERT CLIFFS' COORDINATING COMMITTEE, INC., NATIONAL WILDLIFE FEDERATION, AND THE SIERRA CLUB, PETITIONERS

v.

UNITED STATES ATOMIC ENERGY COMMISSION AND UNITED STATES OF AMERICA, RESPONDENTS

BALTIMORE GAS AND ELECTRIC COMPANY, INTERVENOR

Petition for Review of Action
of the Atomic Energy Commission

JOSEPH F. HENNESSEY,
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I N D E X

	Page
Counterstatement of the issues	III
Counterstatement of the case	1
Argument:	
The Commission's NEPA Regulations Impose Appropriate Environmental Requirements in Regard to Nuclear Power Reactors Previously Authorized for Construction and Proceedings Looking to Suspension of a Permit for any Such Facility Must Rest on Grounds of Non-compliance With Those Requirements.	15
1. Commission Action for which Review Sought	17
2. Water Quality Matters	19
3. The Decision of the Maryland Public Service Commission	22
Conclusion	26

CITATIONS

Cases:	
Northern States Power Co. v. State of Minnesota, 320 F. Supp. 172 (D. Minn.)	26
Statutes:	
Atomic Energy Act of 1954, as amended, 42 U.S.C. 2011......	3
Sec. 189b., 42 U.S.C. 2239(b)	17
Sec. 191, 42 U.S.C. 2241	3
Sec. 274, 42 U.S.C. 2021	26
Federal Water Pollution Control Act, P.L. 91-224, 84 Stat. 91 Sec. 21(b)	11, 19
National Environmental Policy Act of 1969, P.L. 91-190, 83 Stat. 852	1, 6
28 U.S.C. 2342	17
Miscellaneous:	
Annual Report to Congress of the Atomic Energy Commission for 1970, "Major Activities in the Atomic Energy Programs, January-December 1970".	21

Miscellaneous—Continued | Page

Atomic Energy Commission Rules and Regulations (Title 10 CFR):

Part 2, Subpart B 10
Sec. 2.104 4
Sec. 2.760 6
Sec. 2.764 5
Part 20 .... 4, 25
Part 50 25
Appendix D 8, 9, 10, 11
Sec. 50.35(a) 4
Sec. 50.35(c) 5
Sec. 50.58(b) 5
Sec. 50.109 25

Baltimore Gas and Electric Company Environmental Report to the AEC on the Calvert Cliffs Nuclear Power Plant ... 21

34 F.R. 11603 (1969) 5
35 F.R. 8594 (1970) 8
35 F.R. 12566 (1970) 7
35 F.R. 18385 (1970) 25
35 F.R. 18469 (1970) 9

Hearings before the Joint Committee on Atomic Energy on "AEC Authorizing Legislation, FY 1971", 91st Cong., 2d Sess., Part 3 (March 1970) 20

Hearings before the Joint Committee on Atomic Energy on "Environmental Effects of Producing Electric Power", 91st Cong., 2d Sess., Part 2, Vol. II (1970) 21

<u>Matter of Application of Baltimore Gas and Electric Company</u> (No. 6394, Public Service Commission of Maryland, January 19, 1971). 22

COUNTERSTATEMENT OF THE ISSUES

Whether the regulations adopted by the Atomic Energy Commission for implementation of the National Environmental Policy Act of 1969 in the licensing of nuclear power reactors make appropriate provision for the application of that statute to facilities previously authorized by the Commission for construction.

IN THE
UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

No. 24,839

CALVERT CLIFFS' COORDINATING COMMITTEE, INC., NATIONAL WILDLIFE FEDERATION, AND THE SIERRA CLUB, PETITIONERS

v.

UNITED STATES ATOMIC ENERGY COMMISSION AND UNITED STATES OF AMERICA, RESPONDENTS

BALTIMORE GAS AND ELECTRIC COMPANY, INTERVENOR

Petition for Review of Action
of the Atomic Energy Commission

BRIEF FOR THE RESPONDENTS

COUNTERSTATEMENT OF THE CASE

Petitioners herein seek "review of the order of the Atomic Energy Commission refusing to issue an order to the Baltimore Gas and Electric Company to show cause why the construction permit for the Calvert Cliffs Nuclear Power Plant should not be suspended pending a complete study of the environmental impact of the plant", as assertedly required by the National Environmental Policy Act of 1969 (NEPA),[1/] and review of the

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1/ P. L. 91-190, 83 Stat. 852 (January 1, 1970).

Commission's refusal to take certain other actions in regard to the Calvert Cliffs facility which petitioners claim are required by the referenced Act. (Pet. Rev., 1-2; J.A.II,31-36). The Calvert Cliffs Nuclear Power Plant is a twin unit nuclear generating facility licensed by the Commission for construction on July 7, 1969, prior to enactment of NEPA. Petitioners are three conservationist organizations which petitioned the Commission approximately one year later to take a number of post-licensing actions asserted to be required by the enactment of NEPA. Certain of the steps requested by petitioners were later taken by the Commission and action on others was in a form different than that which petitioners claimed to be required. The relevant facts may be summarized as follows:

(1) <u>AEC Licensing Proceedings for the Calvert Cliffs Plant.</u> On January 25, 1968, the Baltimore Gas and Electric Company filed an application with the Atomic Energy Commission for licenses to construct and later operate two nuclear power reactors to be located at the company's site on the western shore of Chesapeake Bay in Calvert County, Maryland. The two reactors are substantially similar pressurized water facilities (i.e., water under pressure is used as a coolant to transfer the heat from the reactor core to the steam generators), each having an initial power rating of 2440 thermal megawatts (about 845 electrical megawatts) and a somewhat higher ultimate expected power level. The company is a public utility engaged, <u>inter alia</u>, in the production and sale of electrical energy

in central Maryland and it contemplates use of the nuclear facility for the generation and ultimate sale of electricity (J. A. II, 11-14).

The application, together with its subsequent amendments, was reviewed by the regulatory staff of the Atomic Energy Commission which concluded that the applicant had satisfied all Commission requirements for the issuance of construction permits. More particularly, the regulatory staff found that permit issuance would be consistent with the standards of the Atomic Energy Act of 1954 (42 U.S.C.2011, et seq.), as implemented by the Commission's regulations, relative to the public health and safety and the common defense and security (J.A. II, 12).

On April 3, 1969, following completion of this review, the Commission published a notice in the Federal Register advising that a public hearing would be held on the application the following month at a location near the site of the proposed facility. The notice set out the issues to be considered and initially decided by an Atomic Safety and Licensing Board (appointed by the Commission pursuant to Section 191 of the Atomic Energy Act, 42 U.S.C. 2241) as a basis for determining whether provisional construction permits should be granted.

These issues dealt solely with whether the application satisfied the radiological safety and national security standards set forth in the Commission's regulations (10 CFR §§ 2.104 and 50.35(a)).

At the ensuing hearing, issuance of construction permits was opposed by the Chesapeake Environmental Protection Association, Inc., an intervenor party to the proceeding. The major contested issue involved the effects on seafood and humans of the controlled discharge into the Bay of liquid radioactive waste materials from the plant (J. A. II, 12,19). None of the petitioners here participated in this licensing proceeding.

On June 30, 1969, the Atomic Safety and Licensing Board rendered an initial decision authorizing issuance of provisional construction permits to the applicant. The board made findings favorable to the applicant on the issues specified in the notice of hearing, found there was no evidentiary support for the intervenor's contentions [2/] and concluded that there is reasonable assurance the subject facility can be

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2/ The board held, in this regard, that although the intervenor had raised questions as to the assumptions underlying the Commission's radiological protection standards (10 CFR Part 20), there was no evidence on which the board could base a refusal to accept those standards (J. A. II, 21-22).

constructed and operated at the proposed site without undue risk to the health and safety of the public (J. A. II, 22-24). In accordance with 10 CFR § 2.764, the initial decision was made immediately effective, subject to review and further decision by the Commission; and on July 7, 1969, the Commission's Division of Reactor Licensing issued provisional construction permits to the company (34 F. R. 11603, July 15, 1969).[3/]

There was no appeal to the Commission from the board's decision; however, the Commission, in accordance with its regulations and practice, undertook its own informal review of the initial decision (J. A. II, 26-30). In a Memorandum dated August 8, 1969, the Commission stated its conclusion that the board's decision was supported by the record of the proceeding and that it should be permitted to become the agency's final

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3/ Under the Commission's regulations, all power reactor construction permits are subject to the limitation that a license authorizing operation of the facility will not be issued until the applicant has submitted, by amendment to its application, the complete final safety analysis report and the Commission has found that the final design provides reasonable assurance that the health and safety of the public will not be endangered by operation of the facility in accordance with the license and the Commission's regulations. 10 CFR § 50.35(c). Prior to issuing an operating license, the Commission must give 30 days notice, published in the Federal Register, of its intent to do so and of the opportunity to request a hearing by any person whose interest may be affected thereby. 10 CFR §50.58(b).

action (J. A. II, 27). The Memorandum went on to discuss a matter raised by the board which the Commission deemed to be of general significance for AEC licensing proceedings, i.e., whether a board can inquire into the validity of standards established by Commission regulations. The Commission stated, in this regard, that while its general licensing regulations are not subject to amendment in individual adjudicatory actions, a licensing board could entertain a challenge to the validity of a Commission regulation if the contested regulation related to an issue in the proceeding; and the Memorandum set forth certain guidelines in respect to such challenges (J. A. II, 27-30).

In accordance with the Commission's regulations (10 CFR § 2.760), the board's initial decision became the final decision of the Commission on August 14, 1969 (J. A. II,27). The Calvert Cliffs power reactors are now under construction, Unit 1 being scheduled for commercial service by the company in early 1973 and Unit 2 one year later.

(2) Petitioners' Post-licensing Requests to the AEC. By letter dated June 29, 1970, petitioners submitted to the AEC a request that the agency take certain actions in regard to the Calvert Cliffs Nuclear Power Plant in light of the enactment of the National Environmental Policy Act of 1969. Petitioners requested the Commission: (1) to order Baltimore Gas

and Electric Company to prepare and submit with respect to the Calvert Cliffs facility the environmental statement called for by NEPA; (2) to begin immediately NEPA environmental studies to determine if any modifications of the facility or its location are required; and (3) to issue an order to the Baltimore Gas and Electric Company to show cause why the construction permits issued on July 7, 1969, should not be suspended pending investigation of NEPA environmental factors (J. A. II, 31-37). Accompanying this request was a petition for rule making, filed on behalf of the same organizations, seeking parallel amendments to Commission regulations dealing with the implementation of NEPA in AEC licensing proceedings (J. A. II, 71-74). Petitioners additionally asked that their submission be considered as comments in a pending NEPA rule making proceeding previously initiated by the Commission itself (J. A. II, 40).[4/]

On August 6, 1970, the Commission published in the Federal Register a notice of "Filing and Denial of Petition for Rule Making in Light of Pending Rule Making Proceeding" (35 F. R. 12566). The notice recited the fact that the Commission was

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4/ Petitioners' rule making request, the related Commission rule making proceeding then under way for implementation of NEPA in AEC licensing proceedings and the substantive provisions of NEPA itself, are discussed in more detail in respondents' brief in No. 24,871, now pending before this Court. In that review proceeding, the same petitioners are disputing the validity of certain aspects of the Commission's final NEPA rule making action. The two cases have been consolidated by the Court for purposes of argument.

then conducting a rule making proceeding, initiated by the agency on June 3, 1970 (35 F. R. 8594), for revision of Appendix D to 10 CFR Part 50 of its regulations to establish a general policy for Commission exercise of its NEPA responsibilities in AEC licensing proceedings; that the proposals and comments made in petitioners' rule making request were germane to the subject of the pending rule making proceeding; that a further separate rule making proceeding was deemed unnecessary; and that the Commission, in the pending proceeding, would consider carefully and address itself to the matters raised by the petitioners' rule making request.

The Commission's notice went on to state that the "requests made by petitioners relating specifically to action in regard to the Calvert Cliffs Nuclear Power Plant have been referred to the AEC's Director of Regulation". The Commission added that: "It is expected that the Director of Regulation will take action on these requests following completion of the rule making proceeding which is presently under way, the outcome of which will determine the action to be taken". (35 F.R.12567).

Thereafter, by a Supplemental Memorandum dated November 12, 1970, petitioners renewed their earlier request for Commission action in regard to the Calvert Cliffs Nuclear Power Plant (J. A. II, 75-79). The Director of Regulation responded to this

filing on November 25, 1970, reviewing the sequence of events previously recited, advising that the NEPA rule making proceeding had not yet been concluded,and assuring petitioners that their requests of June 29 and November 12 relating specifically to the Calvert Cliffs facility "will be considered, and that appropriate action thereon will be taken in the light of the general policy adopted by the Commission upon conclusion of the current rule making proceeding" (J. A. II, 178-179).

On December 3, 1970, the Commission issued a revised Appendix D to 10 CFR Part 50, "Statement of General Policy and Procedure: Implementation of the National Environmental Policy Act of 1969" (35 F. R. 18469, December 4, 1970; J. A. I, 5-10). In its discussion of comments received in the course of the rule making proceeding, the Commission noted that its new policy imposed requirements corresponding with two of the requests made by petitioners, i.e., the new regulations required submission of an environmental report by pre-NEPA construction permit holders "as soon as practicable" and they provided for preparation thereafter of a detailed environmental statement by the AEC (J. A. I, 7). Petitioners' proposal that agency proceedings be initiated looking to suspension of previously issued construction permits pending a NEPA study of the environmental impact of the facilities involved, was not adopted by the Commission. The Commission

stated that whether suspension is appropriate is a matter to be determined pursuant to Subpart B of its Rules of Practice[5/] in the light of the requirements established by the new NEPA regulations (J.A. I,7).

In regard to a further rule making request by petitioners that "backfitting" be provided for in the case of facilities licensed for construction,[6/] the Commission stated that such a course had not been adopted and it set forth the reasons for its position (J. A. I,7).[7/]

The revised Commission regulations for NEPA implementation became effective on January 3, 1971 (J.A. I,8). On January 5, 1971, the Director of Regulation wrote the Baltimore Gas and Electric Company summarizing the facts with respect to the request for a show cause order made by petitioners and recalling the Commission's direction that this request be considered in the light of the requirements of Appendix D to 10 CFR Part 50 as

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5/ 10 CFR Part 2, Subpart B, "Procedure for Imposing Requirements by Order or for Modification, Suspension, or Revocation of a License."

6/ Petitioners had requested that the Commission amend its regulations to require "backfitting" (i.e., the addition, elimination or modification of structures, systems or components of already licensed facilities) where the Commission finds that such action will provide substantial additional protection of the environment (J.A.II,72).

7/ Petitioners' "backfitting" and "show cause-suspension" requests and the Commission's position in regard to them are dealt with in respondents' brief in No. 24,871, in which review action petitioners dispute the Commission's refusal to adopt these rule making suggestions.

ultimately adopted. In the latter connection, the Director of Regulation stated that the revised Appendix D imposed three basic additional requirements on holders of previously issued construction permits. He noted that one of these requirements, submission of an environmental report, had already been complied with by the company on its own initiative on November 18, 1970, and that this report was being processed for transmittal to cognizant agencies for their review and comment. As to the two further requirements (i.e., two new license conditions compelling compliance with (a) applicable Federal and State standards and requirements for the protection of the environment and (b) applicable provisions of Section 21(b) of the Federal Water Pollution Control Act [8/]), the Director of Regulation requested a status report with appropriate documenting material advising as to the steps which have been taken by the company or are yet to be taken in regard to these requirements (J. A. II, 203-205).

By letter dated February 25, 1971, the company responded to the Director of Regulation's request. Its letter referred to the earlier submission of a NEPA environmental report and also noted that the company had forwarded to the AEC a letter dated August 17, 1970, from the Director of the Maryland Department of Water Resources certifying, pursuant to Section 21(b)

8/ P. L. 91-224, 84 Stat. 91 (April 3, 1970).

of the Federal Water Pollution Control Act, that "there is reasonable assurance that the discharge from the Calvert Cliffs Nuclear Power Plant into the navigable waters of the United States will not violate Maryland's Water Quality Standards". In regard to company compliance with other Federal and State environmental standards and requirements, the company submitted a report on approvals already received and the current status of approvals still to be obtained.

On March 12, 1971, a draft detailed environmental statement prepared by the AEC regulatory staff, together with the company's earlier environmental report, was transmitted for comment to those Federal agencies designated by the Council on Environmental Quality (P. L. 91-190, Title II) as having "jurisdiction by law or special expertise with respect to [the] environmental impact involved" or as being "authorized to develop and enforce environmental standards". In accordance with the Commission's regulations (J. A. I,9) notice of the availability of this environmental statement was transmitted to the Federal Register for publication together with a notice asking comments from State and local agencies of any affected State which are authorized to develop and enforce environmental standards. (36 F.R. 5150, March 17, 1971).

On March 17, 1971, the Director of Regulation wrote petitioners' counsel advising that there was no basis indicated

for concluding that Baltimore Gas and Electric Company was not in compliance with the requirements of the Commission's regulations. In view thereof, he stated that there was no proper ground for issuance of the show cause order requested by petitioners.*

(3) The Petition for Judicial Review. On November 25, 1970, petitioners filed the instant review action in this Court. Their petition asked review of: (1) the "order of the Atomic Energy Commission refusing to issue an order to Baltimore Gas and Electric Company to show cause why the construction permit for the Calvert Cliffs facility should not be suspended pending a complete study of the environmental impact of the plant"; (2) the "order of the Atomic Energy Commission in refusing to require Baltimore Gas and Electric Company to submit as soon as possible an environmental statement with respect to the Calvert Cliffs plant"; and (3) the "order of the Atomic Energy Commission in refusing to immediately begin preparation of a detailed environmental statement with respect to the Calvert Cliffs plant", (Pet. Rev. 1-2). In

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* The company's letter to the AEC of February 25, 1971, the Director of Regulation's letter to petitioners' counsel of March 17,1971, and the draft AEC detailed environmental statement, have been added to the record of this proceeding by a supplement to the "Certified List of the Record".

their subsequent statement of issues for review by the Court, filed on January 15, 1971, petitioners state that the following issues will be presented for review "in light of action taken by the defendant AEC" in its rule making issuance of December 3, 1970:

> "(1) Whether the AEC has erred in refusing to issue to the Baltimore Gas and Electric Company an order to show cause why construction at the Calvert Cliffs Nuclear Power Plant should not be suspended pending determination of all relevant environmental issues as required by the National Environmental Policy Act.
>
> "(2) Whether the AEC has erred in refusing to impose on the Baltimore Gas and Electric Company with respect to the Calvert Cliffs Nuclear Power Plant the continuing obligation to add, eliminate or modify the structures, systems or components of the plant if such action will provide substantial additional protection of the environment as required by the National Environmental Policy Act."

In a separate petition for review filed with the Court on December 7, 1970, (No. 24,871) petitioners dispute compliance with NEPA of certain provisions of the AEC's rule making action of December 3, 1970. By order of the Court, the two proceedings have been consolidated for purposes of argument.

ARGUMENT

The Commission's NEPA Regulations Impose Appropriate Environmental Requirements in Regard to Nuclear Power Reactors Previously Authorized for Construction and Proceedings Looking to Suspension of a Permit for any Such Facility Must Rest on Grounds of Non-compliance With Those Requirements.

Petitioners' brief herein raises contentions and advances supporting arguments which are substantially the same as certain of those involved in No. 24,871, a proceeding in which petitioners are challenging the Commission's rule making action of December 3, 1970.[9/] Since the two proceedings have been consolidated by the Court for purposes of argument, respondents, rather than restating positions set forth in their brief in No. 24,871, are incorporating herein by reference the relevant portions of that brief, *viz.*, Parts I A. and B., and Parts III and IV. We show there, *inter alia*, that the Commission has made appropriate provision in its revised NEPA regulations for the application of that statute to facilities previously authorized for construction - an application that actually antedates the point in time in the AEC licensing process when the agency's "major Federal action" will occur

9/ In this regard, petitioners note at the outset of their brief that their written argument in this case "is virtually identical to one of the written arguments in No. 24,871". (pet. brief, p. 2).

for these facilities, i.e., consideration of a facility operating license. We go on to show that the reasonableness of the Commission's regulations in respect to facilities in the subject category is properly to be judged in the light of the environmental safeguards hitherto applicable to these facilities, the further measures imposed by the new regulations and the underlying need to avoid unreasonable delays in meeting evident power requirements. We then show that if, as respondents submit, the NEPA requirements imposed on prior construction permit holders are a reasonable exercise of the AEC's statutory responsibilities, the Commission was correct in its consequent position that proceedings looking to suspension of those permits on NEPA grounds are only to be initiated where non-compliance with the new NEPA requirements is indicated. And finally, we show in that brief, that the "backfitting" approach advanced by petitioners is not mandated by the new environmental statute and that the Commission's course in this regard takes proper account of the areas of its own special competence and those of the various other governmental bodies having environmental responsibilities.

Notwithstanding the correspondence in argument outlined above, there are, we believe, specific aspects of the instant proceeding which warrant particular mention. Those aspects are dealt with in the discussion which follows.

1. Commission Action for which Review Sought. Respondents are constrained to note at the outset the uncertainty in the record as to just what AEC action it is that petitioners are appealing from in this proceeding and what issues are properly before the Court.

The petition for review in this case was filed on November 25, 1970, a week prior to Commission adoption of its revised NEPA regulations. That petition purports to seek review of certain "orders" of the Atomic Energy Commission, which are described as Commission "order[s] ... refusing": (a) to issue an order to show cause to Baltimore Gas and Electric Company; (b) to require the company to submit a NEPA environmental report as soon as possible; and (c) to immediately begin preparation of an agency detailed environmental statement.[10/] However, petitioners' position on these matters changed markedly following the Commission's rule making issuance of December 3, 1970. While not specifically amending their petition for review to state

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10/ Respondents would note, parenthetically, that a question did exist at that point as to whether these so-called "refusals" (in reality, agency deferrals of action until completion of a pending germane rule making proceeding) were properly appealable to this Court as "final orders" of the Atomic Energy Commission within the meaning of Section 189 b. of the Atomic Energy Act (42 U.S.C. 2239(b)) and 28 U.S.C. 2342. The subsequent rule making action of the Commission is, however, such a "final order" and petitioners' ensuing steps (*infra*) may be deemed at least a *de facto* amendment of their petition to seek review on the basis of the revised rule.

that review was being sought of this issuance insofar as it applied to the Calvert Cliffs facility, petitioners' statement of issues for review by the Court (filed January 15, 1971) advised that the two issues being presented for review were cast "in light of action taken by the defendant AEC" in its rule making issuance of December 3, 1970. In so acting, petitioners understandably dropped their contentions relating to preparation of an environmental report by the company and an environmental statement by the AEC in view of the steps directed by the revised agency regulations (supra). They added, however, a further issue in regard to the Calvert Cliffs facility - that relating to "backfitting". The latter issue, we would note, quite apart from its lack of mention among the "orders" of the Commission complained of in the petition for review, does not appear to be part of petitioners' underlying request to the AEC for action in regard to the Calvert Cliffs facility; rather, it was one of petitioners' general rule making requests (J. A. II, 36-37, 72).[11/]

While the underlying procedural record is, thus, somewhat confused, respondents are posing no objection to review

11/ Petitioners' brief adds yet a third issue - relating to plant modification on the basis of NEPA environmental studies. This matter, although not previously raised by petitioners in their earlier Court filings, was included in petitioners' request to the Commission for administrative action.

by the Court of the issues which petitioners now seek to raise. A proper jurisdictional basis for review arguably does exist at this time and the same questions are being raised by the same petitioners in No. 24,871, the disposition of which can have application to the Calvert Cliffs facility.

2. Water Quality Matters. The environmental focus of petitioners' submission to the Commission, as well as their brief to the Court, is on matters of water quality - more particularly, the impact of the subject facility on the waters of the Chesapeake Bay. Respondents will not repeat here their arguments in No. 24,871 as to the licensing coverage directed by Section 21(b) of the Federal Water Pollution Control Act. We would only note the additional fact that a Section 21(b) water quality certification has been issued for the Calvert Cliffs facility by the appropriate governmental authority embodying the requisite determination that operation of the facility will not violate Maryland's Federally approved water quality standards for the Bay. (This certification and the permits for use of Bay waters previously issued by the State are set forth at J.A. II, 185-202.)

Petitioners, while acknowledging issuance of the Maryland certificate (although not its legal significance), express their continued misgivings as to the "very little information"

available regarding the plant's "probable impact on the environment of Chesapeake Bay" and submit "[t]here are substantial unanswered questions regarding the oceanography of the Bay" (pet. brief, p. 23). They maintain these misgivings notwithstanding their recognition of the extensive studies and inquiries that have been made in this regard, including a "full hearing by the AEC" on radiological matters, "numerous studies conducted by state and federal authorities and by ... Baltimore Gas and Electric Company" and the "impressive list of permits" for the plant issued by Federal and State authorities with environmental responsibilities (pet. brief, pp. 21-22).

Respondents, it should be emphasized, are in no way disputing the desirability of further research on Bay effects or, for that matter, research relating generally to the environmental impact of power plant condenser cooling water discharges. The AEC, in fact, has long supported a substantial research program on the thermal effects of nuclear power plant operations, including research specifically relating to the Chesapeake Bay - and this research work is continuing.[12/]

12/ See, e.g., Hearings before the Joint Committee on Atomic Energy on "AEC Authorizing Legislation, FY 1971", 91st Cong., 2d Sess., Part 3 (March 1970), pp. 1342, et seq. The Commission's annual report to the Congress for 1970 states that AEC research on the thermal effects of power plant operation will total $3.2 millions in fiscal year 1971. The report also describes, generally,the new work initiated at the AEC's own facilities and the coordination

(continued next page)

In the latter regard, a further program was initiated during the past year, entailing a multi-disciplinary cooperative study of the problems associated with the siting of nuclear power plants on the Bay.[13/] And Baltimore Gas and Electric Company has, of course, undertaken and continues to carry out its own studies and research on Bay effects.[14/]

12/ (Continued)

of AEC efforts with those of other Federal agencies through an interagency task group under the auspices of the President's Office of Science and Technology. See "Major Activities in the Atomic Energy Programs, January-December 1970", pp. 43-49.

13/ This study involves the following organizations: Atomic Energy Commission; Chesapeake Bay Institute, Johns Hopkins University; Chesapeake Biological Laboratory, Natural Resources Institute, University of Maryland; Department of Geography and Environmental Engineering, Johns Hopkins University; Virginia Institute of Marine Science, Gloucester Point, Va.; Department of Natural Resources, State of Maryland; Baltimore Gas & Electric Co.; Potomac Electric Power Co.; and Virginia Electric & Power Co. See the AEC's annual report to the Congress for 1970, note 12, *supra*, p. 59.

14/ See, in this regard, the permits for use of Bay waters issued by the State of Maryland (J. A. II, 195-202); see also "Environmental Effects of Producing Electric Power", Hearings before the Joint Committee on Atomic Energy, 91st Cong., 2d Sess., Part 2, Vol. II (1970) pp. 2242, *et seq.*; and see further the company's Environmental Report to the AEC on the Calvert Cliffs facility (November 16, 1970), pp. 6-25.

But, with full recognition accorded to the desirability of further study and research in the general area of water quality effects, a substantial body of environmental information has already been garnered - information deemed sufficient here by the responsible Federal and State authorities to sanction the planned operation of this facility under environmental safeguards which they believe adequate. It was presumably this background which led the Governor of Maryland's Task Force on Nuclear Power Plants to conclude in its report on the Calvert Cliffs plant:

> "Based upon careful consideration of available evidence the task force concludes that the Calvert Cliffs Nuclear Power Plant, operating in compliance with Federal and State laws and regulations, does not in itself constitute a threat in any significant way to health, safety or economy of the State of Maryland or its citizens, nor will the plant seriously impair the quality of the Chesapeake Bay environment."15/

3. The Decision of the Maryland Public Service Commission. Petitioners' Supplemental Memorandum to the Commission of November 12, 1970 - submitted in support of their "show cause" and related requests - stressed the significance of the pendency

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15/ Cited in the Maryland Public Service Commission's decision of January 19, 1971, granting a certificate of public convenience and necessity for the Calvert Cliffs plant. Matter of Application of Baltimore Gas and Electric Company (No. 6394, Public Service Commission of Maryland). This decision (which is included in the supplemental "Certified List of the Record") is further discussed in Section (3), *infra*.

before the Maryland Public Service Commission of the application by Baltimore Gas and Electric Company for a certificate of public convenience and necessity for the Calvert Cliffs plant (J. A. II, 77-78). The Public Service Commission has, of course, now rendered its decision, granting the certificate (supra) and we believe that certain portions of that decision are worth noting here.

In finding that the company had established the need for the facility to meet present and future service demands, the Public Service Commission decision states (p. 31):

> "The plant will have a capacity of about 845 megawatts in 1973 when the first unit comes on line and about 1,710 megawatts in 1974 when the second unit is scheduled to begin operations. The present generating capability of the Company is about 3,000 megawatts. The Company's load has been growing during the past two years at the rate of 12 percent. Without the facility at Calvert Cliffs the Applicant in 1973 would have essentially a zero reserve capacity and in 1974 the load during peak is estimated to exceed the capacity by 336 megawatts (or by minus 8.3 percent)."

The decision goes on to state: "Most informed sources, including this Commission, believe that a 20-percent reserve capacity is desirable. For the Company this can only be achieved by completion of the Calvert Cliffs facility." (p.32).

In the area of environmental effects, the PSC decision discusses the water quality permit granted by the State for use of Bay waters (J. A. II, 185-202) and adverts to its description by the head of the Department of Water Resources as "the most restrictive permit ever issued by his Department" and perhaps "the most restrictive in the Nation" (p. 36). Under the permit, the company will be subject to a "continued obligation to demonstrate that the water quality is not impaired and water resources are not damaged by the operation of the plant"; there will be State as well as company monitoring of plant operations; and "[v]iolation of any restrictions and conditions in the permit or applicable provisions of law could cause the Department to revoke the permit" (p. 36; see also J.A. II, 195-202).

The Public Service Commission went on to hold that it would retain jurisdiction over the design of the plant as well as its operation, "and will require the backfitting of technological advancements, as they become available, that provide reasonable additional protection necessary for the public health and safety or protection of the environment" (p. 39). In view of petitioners' "backfitting" contentions in the instant proceeding, respondents would add the parenthetical note that, insofar as the State's "backfitting" requirements relate to other than radiological effects, they will be subject to the NEPA condition which the AEC has added to the Calvert Cliffs permits (supra, p. 11) and non-compliance would

be a basis for appropriate AEC enforcement action under those construction permits or any later operating licenses issued. In the area of radiological health and safety, the AEC, of course, has its own "backfitting" requirements (10 CFR Section 50.109), which will be fully applicable to the Calvert Cliffs facility. It is also worth noting, in view of petitioners' oblique observations concerning the discharge of radioactive effluents and their control (pet. brief, pp. 21-22), that this facility will be subject to AEC regulatory provisions which require that radioactivity in effluent releases be kept "as low as practicable" and to the Commission's implementing design and operating requirements.16/

In short, the environmental regime for this facility will encompass - and on a continuing basis - a full battery of practicable governmental safeguards.

16/ "Control of Releases of Radioactivity to the Environment", Amendments to 10 CFR Parts 20 and 50 (35 F.R. 18385, December 3, 1970). One section of the water use permits issued to the company by the State contains certain restrictions on radionuclide concentrations in liquid waste discharges (J.A. II, 193-4). These restrictions, the permits recite, have been accepted by the company "subject to the qualification that if there is a final decision by a court having jurisdiction over the State...(including a denial of certiorari by the U. S. Supreme Court of a decision by any U.S. Court of Appeals) that the United States, through the Atomic Energy Commission, or any other duly designated Federal agency, has the exclusive authority to regulate the discharge of radioactive effluents from nuclear electric generating facilities and thus has preempted the right of a State to regulate [those] discharges, such provisions in these Permits...as may be in conflict with such decision, shall become null and void". (J.A. II, 198). These

(Continued on next page)

CONCLUSION

For the foregoing reasons, it is respectfully submitted that the Commission action herein should be affirmed.

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Date: March 1971.

16/ (Continued)

restrictions are also noted in the Memorandum of Understanding between the State of Maryland and the AEC in connection with their Agreement for AEC discontinuance and State assumption of certain regulatory authority over nuclear activities within the State (exclusive, inter alia, of nuclear power reactors), pursuant to Section 274 of the Atomic Energy Act (42 U.S.C. 2021). The Memorandum recognizes the pendency of Northern States Power Co. v. State of Minnesota (320 F. Supp. 172, D. Minn; on appeal, Court of Appeals for the Eighth Circuit), and states that the subject "turnover" arrangements do not affect the position of either party "with respect to the legal authority, or the lack thereof, of the State to impose requirements, for purposes of protection against radiation hazards, upon activities within the State licensed by the Commission" (35 F.R. 20020, December 31, 1970).

IN THE

UNITED STATES COURT OF APPEALS

FOR THE DISTRICT OF COLUMBIA CIRCUIT

24,839

CALVERT CLIFFS' COORDINATING COMMITTEE, INC.,

NATIONAL WILDLIFE FEDERATION, AND

THE SIERRA CLUB,

Petitioners ,

v.

U.S. ATOMIC ENERGY COMMISSION,

UNITED STATES OF AMERICA,

Respondents,

BALTIMORE GAS AND ELECTRIC COMPANY,

Intervenors.

REPLY BRIEF FOR PETITIONERS

United States Court of Appeals
for the District of Columbia Circuit

FILED APR 6 1971

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INDEX

Reply Brief for Petitioners. 1

Conclusion. 7

Cases:

Environmental Defense Fund v. Hardin, ___ U.S. App. D.C. ___, 428 F. 2d 1093 (1970). 2

Medical Committee for Human Rights v. SEC, ___ U.S. App. D.C. ___, 432 F. 2d 659- 668 (1970). . . 2

Northern States Power Co. v. Minnesota, ___ F. Supp. ___ (D. Minn., 1970). 5

Statutes:

Annotated Code of Maryland Section 54A, Article 78 (1969 Replacement Volume). 6

Miscellaneous:

35 Fed. Reg. 18385 (Dec. 3, 1970). 5

IN THE
UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

Calvert Cliffs' Coordinating Committee, Inc. National Wildlife Federation The Sierra Club Petitioners v. U.S. Atomic Energy Commission United States of America Respondents Baltimore Gas and Electric Company Intervenors	No. 24,839

Reply Brief for Petitioners

Despite some apparent confusion on the part of Respondents and the Intervenor we submit that the issues in this proceeding are clear. In the original petition to the AEC (Jt. App. (Vol. II) 32) we requested, inter alia: 1/

> 1) that the AEC issue to Baltimore Gas and Electric Company an order to show cause why the construction permit of the plant should not be suspended pending a full exploration of environmental issues (by letter dated March 17,

1/ The request contained in the petition relating to submission of the applicants environmental report and preparation of a detailed environmental statement have been granted by the AEC. Jt. App. (Vol. II) 179; Paragraphs 1 & 4, Appendix D (Jt. App. (Vol. I) 0). The request for backfitting as applied to the BG&E plant is moot inasmuch as such a requirement was imposed by the Maryland Public Service Commission in its decision of January 19, 1971, p. 39, (included in the Certified Record). The AEC has agreed to enforce this provision. (Resp. brief, pp. 24-25).

1971 the AEC confirmed its denial of that request (copy attached). 2/

2) that the AEC not only prepare a detailed environmental statement but that on the basis of the data contained therein it consider modification of the location, design, method of construction or operation or any other aspect of the plant as required (this request was denied with respect to BG&E and all similar plants on December 4, 1970 in Appendix D (Jt. App. (Vol. I) 9-10).

An examiation of the briefs by Respondents and the Intervenor suggests that they view this Court proceeding as the forum for decision, on the merits, of the questions of whether construction of the Calvert Cliffs should be halted and whether any specific modifications in the plant location, design or operation are required for environmental protection. Obviously it is not this Court's function, nor do Petitioners request, that a first impression review of the relevant facts

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2/ Under this Court's decisions in Environmental Defense Fund v. Hardin, ____ U.S. App. D.C. ______, 428 F. 2d 1093 (1970) and Medical Committee for Human Rights v. SEC, ____ U.S. App. D.C. ____, 432 F. 2d 659, 668 (1970) the refusal of the AEC to act upon the petition was the equivalent of an order of denial which would be reviewable here. The Court need not decide that issue inasmuch as the AEC has now formally denied the Petitioners requests involved here.

which would lead to a disposition of those issues be conducted here. The conflicting views between Intervenors and Respondents on the one hand and Petitioners on the other regarding the extent to which the environmental consequences of the plant have been fully investigated substantiates our contention that a full hearing (not necessarily before a board with oral testimony) at which the comments of Federal and state agencies and the public will be considered is necessary.

The AEC in its letter of March 17, 1971, denying the petitioners request for an order to show cause why construction of the plant should not be halted concluded:

> In view of these actions, and in the light of our examination of the information submitted, we find no basis indicated for concluding that Baltimore Gas and Electric Company is not in compliance with the requirements of the Commission's regulations implementing NEPA. Accordingly, there is no proper ground for issuance of the show cause order which petitioners have requested.

Thus the AEC indicates that the only basis upon which a show cause order will be issued is a showing of non-compliance with Appendix D.3/

3/ Intervenor suggests that AEC decision was based upon an investigation of the merits of the environmental studies and protections of the plant. (Brief p. 46). This conclusion might appear reasonable from the AEC brief but it is clear from the March 17, 1971 AEC letter that its only concern was whether the requirements of Appendix D had been met. Those requirements as applied to Calvert Cliffs merely obligate Intervenor to abide by any validly imposed Federal or state standards and to submit an environmental report. As we have argued in No. 24,871, the imposition of that obligation does not constitute a review of the environmental consequences of the proposed action.

The primary legal arguments applicable to Petitioners' case are set forth in the Briefs filed by Petitioners in No. 24,871 and we will not reiterate those arguments here.[4/] In this brief Petitioners will comment briefly on the factual matters alleged by Respondents and Intervenor in their briefs.

The allegation that all radiological environmental factors have been adequately resolved by the AEC and the Maryland Department of Water Resources is clearly erroneous. The Water Use Permit issued by Maryland sets standards for liquid radiological releases (no limitation was imposed on gaseous releases) far below the levels permitted by the AEC under 10 CFR Part 20 (Inter. brief, pp. 15-16) and the AEC has successfully contended that its authority on this matter

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4/ We do note that the Intervenor here (brief pp. 26,54) places substantial reliance upon the state of completion of the Calvert Cliffs plant as a basis for rejecting possible alternatives. This of course reinforces our conclusion that continued construction of the plant does inhibit efforts to minimize the environmental impact of the plant by using alternatives.

preempts the State radiological standard.5/ Northern States Power Company v. Minnesota _____ F. Supp. _____ (D. Minn, 1970) It is true, as Intervenor indicates (brief, pp. 12-15) that the AEC has recently amended its regulations to require that all radioactive releases from plants be kept "as low as practicable." 35 Fed. Reg. 18385 (December 3, 1970). But as Intervenor also indicates (brief, p. 13) its planned method of operation is "expected" to produce releases of radioactivity at or below 1% of 10 CFR Part 20 limits but obviously Intervenor lacks the confidence in that expectation because it has refused to voluntarily comply with a requirement to that effect contained in the Maryland Water Use Permit. See Jt. App. (Vol. II) 193-194, 198. Nor has Intervenor adopted the essentially "zero release" of liquid radioactive wastes system installed by Consumers Power Company in its Palisades Nuclear plant. See Consumer Power Company Amici brief, p. 16 in No. 24,871.

5/ The AEC refers to the statement by the Maryland Public Service Commission that the Calvert Cliffs Water Use Permit is the "most restrictive in the nation" (Resp. brief, p. 24) but fails to mention that this statement refers to the radiological release levels which the AEC claims do not apply.

Intervenor notes that a water temperature increase of 10°F caused by the operation of the plant is permissible under the Maryland Water Use Permit (Brief, p. 14) It does not follow that a 10°F increase will not have adverse consequences on the environment of the Bay and as indicated in our main brief there is substantial scientific doubt on this subject. (See also the Report of the Study Panel on Nuclear Power Plants of the Maryland Academy of Science, p. 32-33 (Intervenor's Brief, p. 23). The Study Panel also concluded "we recognize that there are many areas in which further research is needed. . ." (Intervenor's brief, p. 24). A number of states have set thermal increases at substantially lower levels. For instance in Virginia the Water Quality Standards for the Chesapeake Bay do not permit temperature increases above 4°F. and during the summer months a 1.5°F. increase is the maximum permitted.

The review by the Maryland Public Service Commission was for the issuance of a certificate of public convenience and necessity. Section 54A, Article 78, Annotated Code of Maryland (1969 Replacement Volume). Its decision was based upon data submitted to it by the parties and was not conducted under the requirements contained in NEPA that the licensing agency itself undertake studies (if there is no reliable available study) to determine relevant facts related to the environmental

issues. Thus that review was based upon the evidence already available and did not overcome any of the deficiencies in knowledge associated with the plants effect on the environment noted in our main brief. This PSC review is a classic example of the problems recognized by Congress in passing NEPA and the need for a mechanism to fully investigate environmental consequences of federal actions and to consider those consequences in federal decisions.

Conclusions

Petitioners stress again that there is no desire to require the AEC to duplicate the work of other agencies. To the extent that in a specific case the record before the AEC persuades it that as to an aspect of the plant operation no further study of environmental consequences is needed, then it would make that judgment and use the studies and other comments received as a basis for its decision. By the same token in deciding whether to halt construction of a plant or to modify the plants construction permit the AEC would consider, *inter alia*, the factors raised by Intervenors in their brief.

There is no attempt by Petitioners to have this Court decide whether to halt construction or modify the construction permit of the Calvert Cliffs plant. Intervenor apparently feels compelled to present its case on the issues. We welcome Intervenors comments and trust that this Court will take action which will allow the public and relevant federal and state agencies an opportunity to present evidence and argument on these issues to the AEC.

Respectfully Submitted,

BERLIN, ROISMAN & KESSLER

BY Anthony Z. Roisman

Anthony Z. Roisman

IN THE
UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

CALVERT CLIFFS' COORDINATING COMMITTEE, INC. NATIONAL WILDLIFE FEDERATION, and THE SIERRA CLUB, Petitioners, v. U.S. ATOMIC ENERGY COMMISSION, UNITED STATES OF AMERICA, Respondents.	No. 24,839

CERTIFICATE OF SERVICE

I hereby certify that on April 1, 1971 a copy of the attached Reply Brief in the above-captioned proceeding was served on

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